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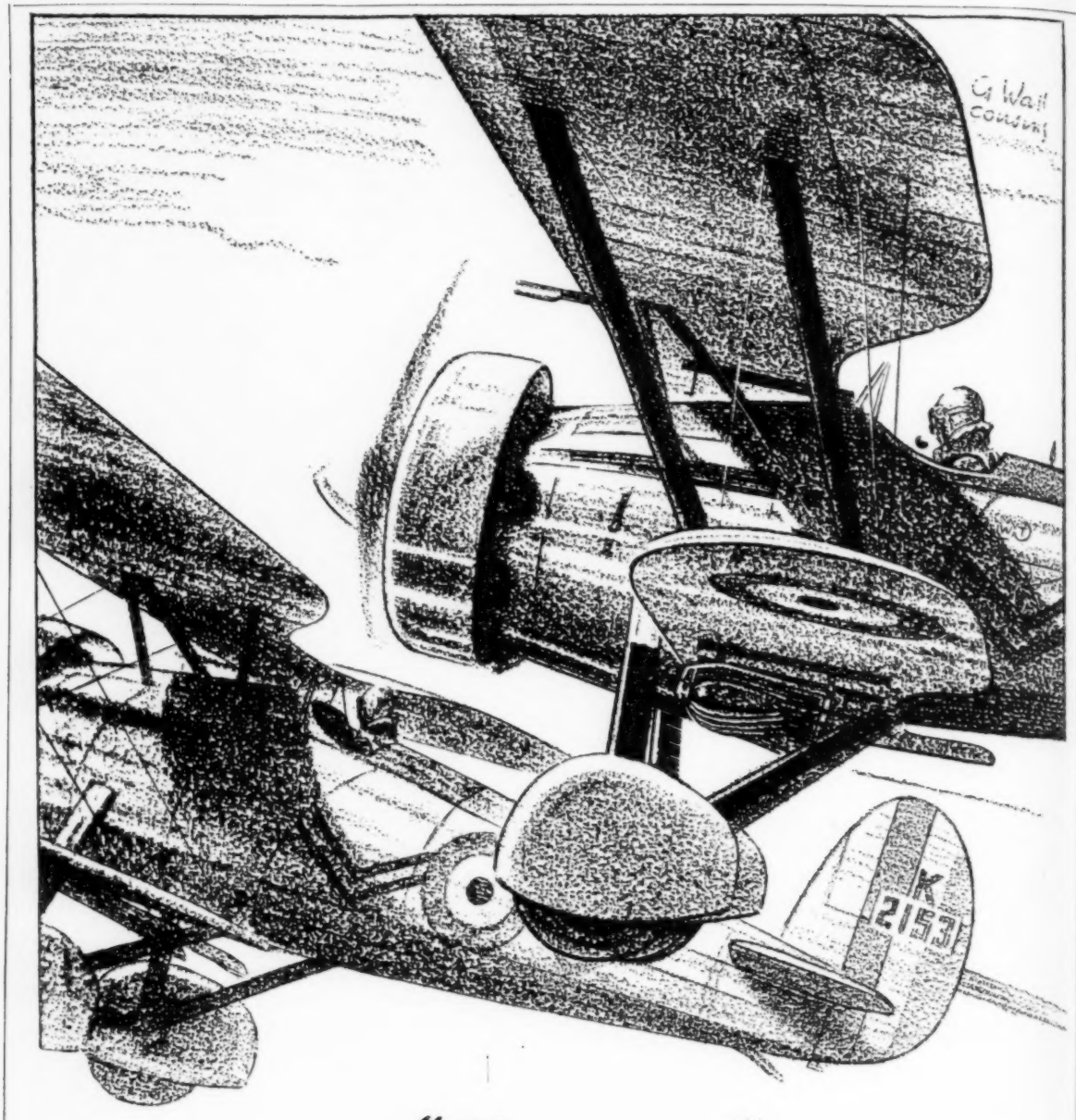

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

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DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1933.
Apr. 1. Women's R.A.F. Dinner, Criterion Restaurant.
Apr. 1. No. 46 Sqdn. Reunion Dinner, Hotel Metropole.
Apr. 4-23. Air Rally at Algiers.
Apr. 6. "Lessons of the Do.X," Lecture by Dr. C. Dornier before R.Ae.S.
Apr. 16. National Aviation Day Display at Gravesend Aerodrome.
Apr. 27. "Seaplane Research," Lecture by H. M. Garner before R.Ae.S.
Apr. 28. Junior Ae.C. Dinner to Sqd. Ldr. Gayford and Flt.-Lt. Nicholetts.
May 1. Entries close at ordinary fee for King's Cup Race.
May 16-22. International Rally, Vienna.
May 19. Entries close at double fee for King's Cup Race.
May 20. G.A.P.A.N. Annual Civil Air Display, Brooklands.
May 20. Opening of R.A.F. Rifle Association's Meeting at Bisley.
May 25. Tourist Rally at Wiesbaden.
May 27. Reading Ae.C. Annual "At Home."
May 28. Deutsch de la Meurthe Cup, Etampes.
May 30. Wilbur Wright Memorial Lecture before R.Ae.S.
June 5. "Morning Post" Race, Heston.
June 5. Lincs. Ae.C. Air Pageant and Opening of Aerodrome at Holton-le-Clay, Grimsby.
June 5. Skegness Flying Meeting.
June 5. Northamptonshire Ae.C. Annual Air Pageant.
June 7. Household Brigade Flying Club Meeting.
June 10. Henly's Rally, Heston.
June 11. International Meeting, Brussels.
June 15-18. Aero Club of France Tourist 'Plane Meeting.
June 16. Mayor's Aerial Garden Party, Eastbourne.
June 17. Bristol Airport Flying Meeting.
June 17. Official Opening of Maidstone Airport and Ae.C.
June 21. Official Opening of Norwich Municipal Airport by H.R.H. the Prince of Wales.
June 24. Royal Air Force Display, Hendon.
July 1. Merseyside Aviation Display and Opening of Speke Aerodrome, Liverpool.
July 2. 12-Hour Contest of Distance, Angers.
July 8. King's Cup Air Race, Hatfield.

EDITORIAL COMMENT

WE all know what the ostrich is supposed to do when danger threatens. It is not a realist. It refuses to face facts. With its eyes buried in the sand it hopes that all will be for the best in this best of all possible worlds.

No one has ever denied that Mr. Ramsay MacDonald is an idealist. Realism has never been his strong point. Nevertheless, in his speech before the Disarmament Conference he delivered a brief lecture on realism. In the course of his speech he said:—

"Like Ostriches"

> "We do not want any of you to refrain from signing (*i.e.*, a disarmament agreement), because with justice you can ask yourselves 'Will those rules ever be carried out? Will agreements come to here really be fulfilled?' It is that scepticism which is the blight of international peace."

That passage is certainly an appeal to idealism if ever there was one. It begs and implores the Conference to put aside thoughts of realities and to sign something whether the nations who sign believe that the agreement will be of any use or not. The passage is an apotheosis of humbug. Yet a few moments later, in the same speech, Mr. MacDonald went on to say to the Conference: "Reality is the most awkward thing that some of you meet with. But you are not going to meet it successfully if you are like ostriches and bury your head in the sand and wait till it has passed you rather than passing it with courage yourself."

Here we get a glorification of realism. Which, in the name of common sense does Mr. MacDonald want the Conference to be, realist or idealist? Does he prefer, in the words of a great novelist who has just died, "The City of Beautiful Nonsense" or "The World of Wonderful Realities?" If the Conference yields to his urgings and signs an agreement while believing that the rules contained therein will never be carried out, will it not be giving a very excellent exhibition of the fabled ostrich? What service can it possibly do to the cause of peace in the world, or to the cause of saving civilians from the horrors of war, to sign an agreement which it is doubted (with justice, as Mr. MacDonald admitted) will be kept?

The whole trouble with this Conference has been

that it has made no distinction between agreements and rules which are likely to be kept and those which have no chance of being kept. The distinction is not really very hard to draw. As Mr. Spaight has pointed out in his books, rules of war which attempt to deprive a belligerent of his natural rights have no chance whatever of being observed. On the other hand, reasonable regulations are generally observed by belligerents. There are rules about prisoners of war, and they have generally been observed, except, of course, in savage warfare. A rule forbidding the spreading of disease germs among the population of the enemy will probably be observed in the future as it has been in the past. Never has any attempt been made to use poison gas against a civil population, and a rule forbidding its use in that way has every likelihood of being kept. We may go further, and prophesy that the use of gas against troops can be forbidden with every hope that the rule will not be broken. Germany has pleaded that before the last war she had not signed the convention forbidding the use of gas; but, in any case, her use of it shocked the conscience of the whole world, and it is an important point that the use of gas was never extended to any front other than the Western. The Allies would have been quite justified in using it against Turks and Bulgarians, but they never availed themselves of their undoubted rights in that respect. These are a few examples of rules which may profitably be made at Geneva.

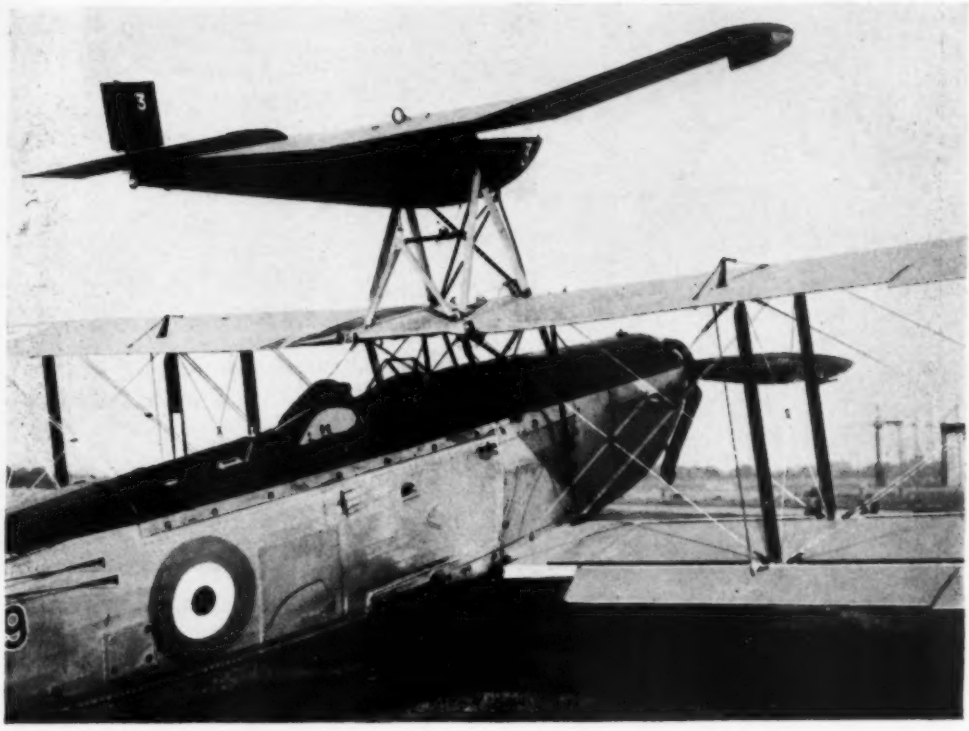
Let us turn to the other side of the picture. A prohibition of aerial bombing has no earthly chance of success, for the simple reason that it attempts to deprive a belligerent of his natural rights. The same applies to the use of heavy artillery. Big guns may not be made during peace, but the moment that war breaks out the gun foundries will be busy at once. The bombing aeroplane is only a weapon for extending the range of the gun. Its missile weapon is practically the same. As we have pointed out before, a general who knew of a munitions factory out of reach of his artillery would certainly try to use aircraft to destroy it, and in doing so he would be asserting the natural right of a belligerent, whatever the agreements of Geneva might say to the contrary. Everybody at Geneva is well aware that that is what would happen, and so Mr. MacDonald had to admit a "just" doubt of the utility of the agreement which he urged the nations to sign. It would be just as useful to try to forbid the construction of factories which might be used for the manufacture of munitions of war.

The pity of it is that this attempt to get signatures to useless agreements casts suspicion on the sanctity of all rules of war. We have even heard Mr. Baldwin saying that no agreement will be kept, or words to that effect, and it is a thousand pities to create such an impression. Undoubtedly some rules of war will be kept, and we have given a few examples above. Utterly unrestricted warfare, in which, maybe, all prisoners would be tortured to death and no respect would be paid to sex or age, is quite unthinkable. Rules of war we must have, and the only question is where the line should be drawn. Some weapons can be forbidden, but others just as certainly can not. Nothing is more futile than to attempt to forbid the use of bomber aircraft, and the attempt only does harm to those spheres in which the Conference might do really useful work. Why does not some hard-headed realist make this plain to the Conference? The spectacle of ostriches hiding their heads in the sand grows wearisome.

We have mentioned above the case of the heavy gun. Geneva seems to think that limitations of size are very effective things. Mr. MacDonald has also proposed a limitation in the weight of aircraft. There are also suggestions for limiting the size of tanks. We cannot see the force of this line of thought. Without heavy guns, tanks, and bombers, an entrenched infantry line becomes well-nigh impregnable, and war is likely to drag on as terribly and as bloodily as the last one did. It is to the advantage of humanity that, if war must come, the armed forces should arrive at a speedy decision. But for tanks and artillery, the German army might still be entrenched across a section of northern France. The weapons which drove that army out cannot justly be called aggressive. Their task was to restore the integrity of French soil. If that is to be called "offence," then it must follow that every snatch-and-grab raid is justified as a defensive measure. It is most desirable that the weapons which we use should be effective against the armed forces of our enemies. What we do want to abolish are weapons which are most effectual when used against civilians. In this connection Mr. C. R. Fairey has done good service in pointing out, in a letter which we reproduced in FLIGHT last week, that the heavy bomber can only be used to great effect against military objectives. The heavy bomb is designed for the destruction of *materiel*, as is the high explosive shell of the guns. When the artillery comes into action against troops, it uses shrapnel, not high explosive. Likewise the heavy air bomb would not be the best weapon for destroying *personnel*. Light bombs, corresponding as near as might be to shrapnel, would be far more effective for that purpose. Therefore those who would protect the civil population are on the wrong tack when they try to restrict the weight of aircraft. If bombing could effectively be prevented, no nation would stand to gain more from the prohibition than would Great Britain, and therefore the suggestion would deserve the warmest support from every organ of British opinion. But, alas! there is no probability that we, as a nation, will be able to profit by any such development.

Mr. MacDonald, realising that there is no possibility of preventing this, fell back on a proposal to restrict the numbers of warlike aircraft which each nation may possess, and put the maximum at 500, which would provide 42 squadrons on the British model. That happens to be the figure at which our Command, Air Defence of Great Britain, stands at the moment. The Prime Minister admitted that his scheme was rough and ready, and that the figures would require revision. The five Powers which were to be allowed this maximum were Great Britain, France, Japan, Russia, and the United States. Germany was not mentioned. This scheme of equality for five Great Powers takes no account of the special responsibilities of Great Britain overseas. Surely Japan and the United States have not got responsibilities equal to ours. We must have aeroplanes to keep peace in Iraq, Palestine, Transjordan, and elsewhere.

But, after all, as Russia and the United States will certainly not disarm in the air, the whole discussion is doubly a waste of time. Let us get back to realities.



FOR NAVAL CO-OPERATION : The Glider on top of this Fairey III F is loosed in the air as a target for naval A.A. guns. (FLIGHT *Photo.*)

Gosport

By MAJOR F. A. de V. ROBERTSON, V.D.

THE R.A.F. base, Gosport, is locally known as Fort Grange. Fort Grange is, in fact, one of the many old-time forts which abound in the neighbourhood of Portsmouth, and is included within the boundaries of the R.A.F. base. One of the enigmas which no ordinary fellow is able to answer is why some units of the Royal Air Force live at "Stations" and others at "Bases." There may be a reason, but it is not an obvious one ; and the distinction causes much worry to the uninitiated who first try to find their way about the *Air Force List*. Gosport, however, actually is a base in the generally understood meaning of the term, for it is a base for those flights of the Fleet Air Arm who come off aircraft carriers. Normally it only deals with the flights of the Home Fleet, but when occasion demands it also accommodates flights from carriers of the Mediterranean Fleet.

The work of Gosport is very varied. The base is commanded by a group captain who is assisted by three wing commanders, one to deal with technical matters, one in charge of flying, and one on the administrative side. It contains, among other things, a pool of officers who have finished some course or other and are waiting their postings, or who are going through a conversion course (*i.e.*, learning to fly a different type of machine from what they have just been flying), or who are going through a course in radio-telephony, etc. The various activities are organised in five flights, and the best way to deal with Gosport is to take these flights in turn. It may be noted that, whereas Lee-on-Solent deals only with float-planes, Gosport deals only with ship-planes and landplanes.

The work of "A" Flight is co-operation with the Royal Navy, the Army, and the Royal Marines. This sounds rather indefinite, but it means that the flight is very busy. Where Lee does the co-operation with seaplanes, Gosport does it with landplanes. The Navy and the Marines of the Portsmouth establishment have plenty of air work for these two stations to carry out, for it must be remembered that when warships end their cruise and return to Portsmouth the carriers disembark their F.A.A. flights at Gosport, while the cruisers and others land their catapult seaplanes at Lee. The forts round about Portsmouth provide an Army element which also calls at times upon Gosport for some air co-operation. Towing targets is one of the tasks, and our photograph on this page shows an unusual form of target. This is a glider fitted with a gyroscope, the whole mounted on the top of a Fairey III F. It is released at a fixed height in the air, and the guns can fire at it as it glides to earth. Its flight path somewhat resembles that of an old B.E.2.C. when left to itself, for it progresses in a series of stalls and dives. As a target, the Navy do not much care for this glider. Probably they consider it very poor practice for aiming at an aircraft which has a pilot on board. In the same way, small-game shots say that firing at clay pigeons is not good practice, for, whereas a live bird is constantly gathering speed, the clay pigeon is getting slower throughout its flight.

"A" Flight possesses eight aircraft, three "Moths" and five Fairey III F's. Some of the latter are three-seaters and some are two-seaters.

"B" Flight has the task of training Telegraphist Air Gunners (known for short in the Fleet Air Arm as T.A.G.). These are always naval ratings. In the Fleet Air Arm they do not believe in giving either pilot or observer too much to do. The work of the observer is observing, and that is so very important to the Admiral that the observer is not to be distracted from it by sending off the results of his observations by wireless, or by using the gun

INSTRUMENT FLYING : Pilots of the Fleet Air Arm are put through a course of instrument flying at Gosport. This picture shows an Avro " Tutor " with the pupil under the hood. (FLIGHT *Photo.*)

to beat off a hostile attack. Of course, it is possible that when the tail of the machine was being attacked and the T.A.G. was getting busy with his gun just behind him, the observer's natural love of a fight might momentarily distract his attention from an interesting hostile squadron or flotilla on the surface, whose composition and movements it should be his chief duty to observe and report. But when the T.A.G. is air gunning he cannot be telegraphing, so a pause is inevitable. The observer, be it remembered, is invariably a naval officer. The pilot may be an officer of either the Navy or the R.A.F. if the machine is a ship-plane off a carrier ; if it is a catapulted seaplane the pilot is always a naval officer. Again be it remembered that the naval pilots hold temporary commissions in the R.A.F., though the observers are not thus honoured. To complete the story, the fitter and rigger of each machine are airmen, while the T.A.G. is always a naval rating.

The ratings selected to become T.A.G.'s start with a knowledge of wireless by land and sea. Their training commences with a four-weeks' course at the Air Armament School at Eastchurch, and then they come to Gosport for a 12-weeks' course in the air. There are three courses in the year, and about seven ratings are trained in each course. " B " Flight possesses six aircraft, one " Ripon " and five Fairey III F's. Five pilots are kept busy training the T.A.G.'s.

" C " Flight trains F.A.A. pilots in deck landings. The photograph on page 291 shows how this is done. The area of a deck is laid out on the aerodrome, marked at the corners with the letter D. In the photograph a Blackburn " Dart " is practising landings. Conditions are not identical in landing on a marked area on land and in landing actually on a deck which is moving and which may have all sorts of air currents round about it ; but the

THE CHIEF INSTRUCTOR AND FLIGHT COMMANDERS : L. to R. : Flt. Lts. J. N. D. Anderson, H. A. Purvis, Sqd. Ldr. N. P. Dixon, A.F.C., Flt. Lts. G. C. Bladon, F. G. Jennings, and A. F. James. (FLIGHT *Photo.*)

elements of the business can be taught on shore, and when the pilots get on to the carriers they usually adapt themselves very quickly to the altered conditions. This training is one of the most important of the functions of Gosport.

In addition to this, "C" Flight teaches instrument flying according to the syllabus of the Central Flying School, at which the instructors have themselves qualified. The top picture on page 290 shows an Avro "Tutor" with the hood over the head of a pupil.

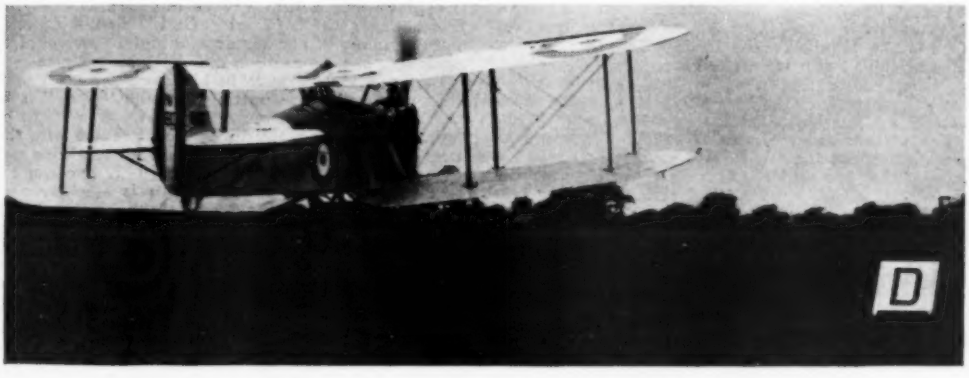
Finally the same flight gives refresher courses to naval officers who have been in the Fleet Air Arm but have returned to general service. The Admiralty allows such officers 12 days in the year in which to take a refresher course at Gosport.

All this work is carried through by one flight lieutenant and one flying officer, but these two have a varied assortment of aircraft with which to work. The flight possesses two "Ospreys," two Avro-Lynx machines, two Avro "Tutors," two "Ripons," one "Nimrod," two "Flycatchers," and two Fairey III F's, so that any form of F.A.A. flight can be served and its pilots trained.

"D" Flight gives a course for pilots of torpedo-planes. Dropping a torpedo is a task of which the pilot cannot be relieved. He has to dive the machine, to flatten out at 15 ft. above the water, and to aim his machine at the target, and so to him must be left the responsibility for releasing the torpedo. The pilots who come to Gosport for this course are roughly half R.A.F. officers and half naval officers with temporary R.A.F. commissions. There are six officers in each course, the course lasts 16 weeks, and there are three courses in a year. The pilots are given a working knowledge of torpedoes and a full knowledge of the art of dropping them. After the course at Gosport they are posted to torpedo flights on carriers. "D" Flight owns four Blackburn "Ripons" and two Blackburn "Darts."

"E" Flight is run in connection with "D" Flight, and its main function is to carry out experiments under the Director of Technical Development at the Air Ministry. Naturally it would not be advisable to publish details about all of this work.

During the war Gosport won a great reputation for itself. This was largely due to the personality of Lt. Col. Smith-Barry, who commanded a Special School of Flying at Gosport, which for a time practically ousted the Central Flying School from its normal position. Previously anyone who could fly at all was thought fit to be an instructor, but at Gosport the art of flying was analysed and so was the art of instruction. Instructors trained at Gosport did a very great deal to make the Royal Flying Corps and afterwards the Royal Air Force the finest air weapon possessed by any country in the later years of the war. That time has passed. Instructors are taught how to teach at the C.F.S. at Wittering, which is as things should be. Gosport is concerned solely with units of the Coastal Area, which is the successor to the Royal Naval Air Service. The notes on its activities given above should show that it is still very busy and is doing work of the very greatest importance.



"DECK" LANDING: A Blackburn "Dart" (Napier "Lion") practising deck landings on a marked area on the aerodrome. One of the corner "D's" can be seen. (FLIGHT *Photo.*)

Royal Air Force Squadrons

Other descriptive articles concerning the work of various R.A.F. Squadrons, etc., have been published in FLIGHT as follow:—

H.M. Aircraft Carrier *Glorious*. May 16, 1930.
No. 4 (Army Co-operation), South Farnborough; No. 17 (Fighter), Upavon, and No. 33 (Bomber), Eastchurch. June 27, 1930.
No. 601 (County of London) (B.) Sq., A.A.F. (at Lympne). August 15, 1930.
No. 43 (Fighter) Sq. (Tangmere). September 19, 1930.
No. 2 (Army Co-operation) Sq. (Manston). December 19, 1930.
No. 101 (Bomber) Sq. (Andover). April 24, 1931.
Nos. 204 and 209 (Flying-Boat) Sq. (Mount Batten). June 12, 1931.
"1890–1912–1931." (An Outline of the Growth of the R.A.F.) June 26, 1931.
Cambridge University Air Sq. (at Old Sarum). July 10, 1931.
Central Flying School (Wittering). July 17, 1931.
Submarine Aircraft Carrier "M 2." July 31, 1931.
Oxford University Air Sq. (at Eastchurch). August 7, 1931.
No. 600(City of London)(Bomber) Sq.,A.A.F. (at Tangmere). August 21, 1931.
No. 605 (County of Warwick) (Bomber) Sq. (Cas. Bromwich). April 1, 1932.
No. 40 (Bomber) Sq. (Upper Heyford). May 13, 1932.
Nos. 7 and 58 (Bomber) Sq. (Worthy Down). June 10, 1932.
A visit to H.M.S. *Exeter* of 2nd Cruiser Squadron, Home Fleet. June 17, 1932.
Oxford University Air Sq. (Eastchurch). July 22, 1932.
Cambridge University Air Sq. (Netheravon). August 5, 1932.
No. 1 Air Defence Group (A.A.F. and Cadre Sqs.). August 12, 1932.
No. 100 (Bomber) Sq. (Donibristle). August 19, 1932.
Scotland's Auxiliaries; No. 602 (City of Glasgow) (Bomber) Sq. and No. 603 (City of Edinburgh) (Bomber) Sq. September 16, 1932.
London's Auxiliaries; Nos. 600, 601, and 604 B. Sq. October 20, 1932.
No. 25 (Fighter) Sq. (Hawkinge). December 8, 1932.
No. 19 (Fighter) Sq. Duxford. January 5, 1933.
Aircraft Carrier H.M.S *Courageous*. January 12, 1933.
Lee-on-Solent. February 9, 1933.
No. 23 Fighter Squadron. March 2, 1933.

U.S. Air Statistics

BRITISH aircraft manufacturers are apt to complain of the bad economic conditions prevalent in this country, but a glance at America shows an even greater depression. In 1927 the United States produced 1,400 civilian machines and 600 military. In 1929 the output of civilian machines had increased to 5,400, the military number remaining at 600. In 1932 the output had sunk to 600 civilian machines and the military still stood at 600. Other statistics show that between 1926 and 1931 the air mail poundage increased from 250,000 lb. to 9,000,000 lb., but by 1932 had dropped 2,000,000 lb. The number of miles flown during the same period increased from 15,000,000 to 50,000,000. Passenger miles flown increased from 25,000,000 to 145,000,000, and passengers carried from 50,000 to 525,000. Between 1929 and 1932 air travel increased 210 per cent., railroad travel decreased 40 per cent., while travel by coach has remained much the same. Comparisons may be odious, but nevertheless are frequently interesting. In 1932 the United States flew 48,000,000 miles on air mail routes, while the rest of the world only totalled about two-thirds of that amount, France with 6,000,000 miles, Germany with 5,000,000 miles, Russia with 3,000,000 miles, Italy also with 3,000,000 miles, and Great Britain with 2,000,000 miles.

MOTHER AND DAUGHTERS : From left to right : Mr. Lindsay Everard's machine ("Gipsy Major"), Mr. Percival's original "Gull" (Napier engine), and Mr. Napier's new machine ("Hermes IV"). (FLIGHT *Photo.*)

PERCIVAL "GULL" IN PRODUCTION

First three Machines delivered

WHEN the Percival "Gull" completed the King's Cup course last year at an average speed of 142.75 m.p.h. it was evident that here was a machine with a performance well above the average. The King's Cup machine was fitted with the then new "Hermes IV" engine, which develops a maximum of 130 b.h.p., with a normal power output of 120 b.h.p. For a three-seater of this relatively low power to average such a speed indicated very efficient aerodynamic design, and the favourable impression created by the machine led Mr. E. W. Percival to decide upon going into production with it. Arrangements were made with George Parnall & Co., of Yate, Gloucestershire, to undertake the construction, and the first production machines have now been finished and delivered to their purchasers.

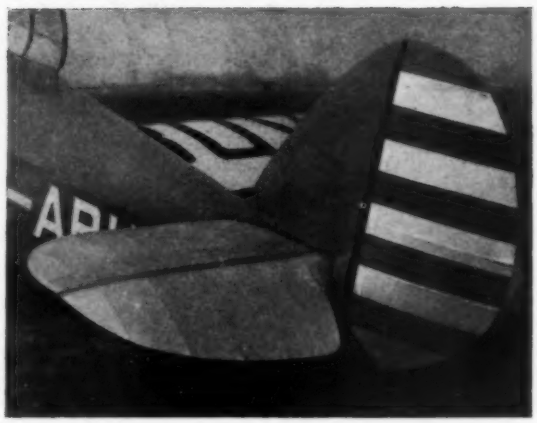
When the Percival "Gull" was first designed, the engine mounting was so planned that quite a variety of power units could be fitted so as to cater for the tastes of different customers. The King's Cup machine was, as already mentioned, equipped with the "Hermes IV" engine. This was so mounted as to leave a fairly long space between it and the engine bulkhead. This made it possible later to instal the Napier 6-cylinder engine, with no change in outward appearance. All that happened was that this engine completely filled the space inside the cowling. Mr. Percival has done a good deal of flying on the "Gull" with the Napier engine, and the extra power was found to put the top speed up to slightly over 160 m.p.h. This means that the machine with this engine cruises comfortably at somewhere not far short of 140 m.p.h., which should be fast enough to satisfy most private owners. With this engine, however, the Percival "Gull" is to be regarded as something of a luxury model, and it is with engines of rather lower power that it will appear in considerable numbers during the coming season.

The first of the Percival "Gulls" has been sold to Mr. W. Lindsay Everard, M.P., who has christened it "The Leicestershire Fox." This machine is fitted with the De Havilland "Gipsy Major" engine of 130 h.p. The second "Gull" has been bought by Mr. C. S. Napier, and is fitted with the "Hermes IV" engine. A third machine has been sent out to Australia, where it will be used for rapid communication in connection with a goldfields expedition. Still others are being completed at the Yate works of George Parnall & Co. Work is still progressing, so that this summer the Percival "Gull" should be a familiar sight at many of our aerodromes and at several of the club meetings, not to mention the King's Cup race.

Parnall's have always had a name for good work, and that which they are putting into the "Gull" is fully up to their usual standard. Particularly fine is the external finish, which has really become comparable with the finish we all expect nowadays on motor cars. With regard to the construction of the machine itself, one can only say that far more care is taken than is officially needed to ensure that the internal work in the machine should be in keeping with the external finish. During a recent visit to the works, we found batches of "Gulls" going through, in various stages of completion. The final erection shed was full of nearly completed machines, while the large workshop was keeping many men employed turning out the wings and fuselages preparatory to their being passed along to the erection shop. We have already described the constructional features of the "Gull," and it is not therefore necessary to go into details again. Since our description, however, both the first "Gull" and its

THE CLEAN UNDERCARRIAGE : Inside the voluminous spats are Palmer wheels. The flap hanging down from the bottom of the fuselage is the air brake. (FLIGHT *Photo.*)

ancestor the "Hendy 302" have done an enormous amount of work without showing any signs of weakness due to wear and tear. As a matter of fact, the whole machine is very ruggedly constructed. The fuselage is undoubtedly a solid piece of work without being over heavy, while the rigidity of the wing, which is a modification of the patented construction originally designed by Mr. B. B. Henderson for the 302, is remarkable. Its torsional strength is very great indeed, and it has the added advantage that the two spars when complete with the drag bracing are to all intents and purposes one tapered spar, and can be treated as such for production purposes. Mr. Martin, the works manager who showed us round, has found that the machine is a comparatively simple one from a production point of view. Most of the units can be completely finished before erection, and none are complicated in design, thus obviating workshop troubles.



THE DIRECTORS: Fin and tailplane are pure cantilever structures, giving a very clean tail. (FLIGHT *Photo.*)

One of our photographs shows the Napier-engined "Gull" standing between two of the production models. The external differences are small, and the general appearance has been but little altered. The front windscreen has been slightly changed, and instead of the three-ply roof with circular roof lights, the production model has a completely transparent roof, consisting of celluloid on a light framework.

This change has made the cabin very light, as well as giving all occupants a good view upwards. The side window on the port side is made to hinge down, and the whole roof hinges up, so that it is very easy to get into and out of the cabin. Two steps let into the port wing root give an excellent foothold, and there is none of that scrambling and slipping which is still necessary on so many machines.

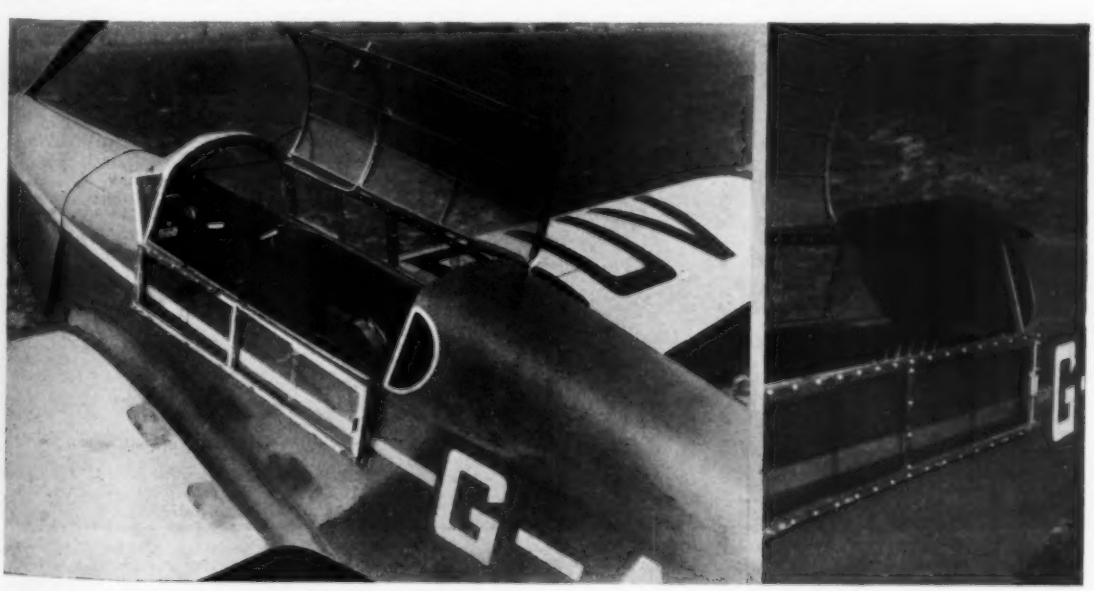
The cabin has the three seats arranged one behind the other, but slightly offset sideways. The middle seat is so designed that when it is not in use the back-rest of it can be unshipped and carried in the luggage locker, while the seat itself is tipped up sideways and strapped to the starboard wall, where it is out of the way and makes it easier for the pilot to get in and out, and gives more leg room for the passenger in the back seat. The luggage locker is in the deck fairing, just behind the back seat.

A clean machine like the Percival "Gull" is apt to glide a long way when the engine is throttled down, owing to the very flat gliding angle. This is one of the drawbacks of improved aerodynamic design, and it is gradually becoming customary in such cases to fit some form of air brake. On the De Havilland "Puss Moth," it will be remembered, the air brake is formed by the undercarriage struts being turned broadside on to the direction of flight. On some American machines a split trailing edge flap is used. In the Percival "Gull" the air brake takes the form of a hinged flap, normally lying flat against the belly of the fuselage. By means of a lever in the cabin this flap can be pulled down so that it projects at a large angle. The ensuing spoiling of the air flow under the fuselage increases the drag very materially, with the result that speed is dropped much more rapidly, while the gliding angle itself becomes steeper. One might have rather feared the effects of this flap on the control power of the tail, but Mr. Percival has not found that control is adversely affected with the flap in the down position.

As wheel brakes are also fitted, the "Gull" can be brought into a reasonably small field, the air brakes making the approach easier, and the wheel brakes pulling the machine up quickly after it has landed. "Spats" enclose more than two-thirds of the wheels.

With the inverted engines used in the "Gull," a long exhaust pipe under the fuselage forms an effective silencer, and the cabin is reported to be very good from the noise point of view.

Further particulars of the "Gull" may be obtained from Mr. E. W. Percival by direct application to his address at 20, Grosvenor Place, London, S.W.1.



LIGHT AND AIR: The cabin of the Percival "Gull," with roof hinged back and side windows down. On the right a view of the luggage locker in the deck fairing. (FLIGHT *Photos.*)

From the Clubs

THE BRISTOL AND WESSEX AEROPLANE CLUB

An Annual Dance may be a stodgy affair or it may, if the management are up to their work, be a thoroughly enjoyable meeting. The Annual Dance of the Bristol and Wessex Aeroplane Club is always of the latter type. They seem to get that party spirit right from the word go and do not want any working up to it.

Over two hundred members met last Friday evening, March 24, at the Spa Hotel, Clifton, Bristol, and until the early morning worshipped at the shrine of Terpsichore. The Bristol Club, besides being the leading club in the West Country, is also one of the pleasantest. The club-house at the Bristol Airport is a model which municipalities at other airports might well copy, and visitors there are always sure of a warm welcome.

Besides the club-house they also have a squash court, and now a tennis court is being built, so when flying is not possible—or for that matter when it is—there will be plenty of facilities for members to get and keep fit. Keeping fit is very important for pilots, and any instructor will tell you that the really fit pupil is the best by a very long way.

For some time now Bristol Airport has been rather tucked away behind a barrier of small side roads along which traffic jams soon impeded progress when an air meeting was in progress. That will all be changed now, as a new arterial road is shortly to be opened which will connect with a new road on to the aerodrome itself. The aerodrome will then be only ten minutes or so from the centre of the city.

People often think of Bristol as "miles from anywhere," so to speak, and, of course, in many ways it is a fairly long distance from anywhere, but on our last visit we were fortunate enough to have the privilege of driving down in one of the new Ford V.8's. Distance simply does not exist for a car like this. The acceleration is so smooth and rapid that it is possible to get ahead of everyone without ever barging or boring along. As a matter of fact, driving a V.8 is much more like driving a steam car than a motor-car, and in just the same way very steep hills can be taken quite slowly in top with the knowledge that one can always accelerate past people if necessary. Birdlip, for example, might well have been a humpback bridge for all the notice this car took of it.

Naturally one would expect a high performance from a 30-h.p. car with a chassis weight as low as this one, while the short-stroke engine built with its two banks at 90 deg. is bound to be smooth, but we certainly did not expect anything quite so fascinating as it actually was. We have never driven anything in which one could put up such a high average in such an effortless fashion, an average almost comparable to some of our lighter aircraft if one takes head winds and out-of-the-way aerodromes into account. It would hardly be politic to say what our time to the Airport was, but we got through quicker than we have ever done before, despite the fact that we made several visits on the way down.

The management of Bristol Airport intend to make the Bristol Air Pageant one of the outstanding Flying Meetings of 1933. It is being held on Saturday, June 17, and will mark the opening of a gala week in connection with the Bristol-Brighton mutual co-operation scheme. A special park adjoining the members' (10s.) enclosure will be provided for the exhibition of machines, a special marquee being erected for the exclusive use of manufacturers' representatives. There will be a race for a cup presented by The Society of British Aircraft Constructors, which will be open to pilots trained *ab initio* by any British Aeroplane Club, the course being non-stop, starting at Shoreham, turning at the Southampton municipal aerodrome and finishing at Bristol. The civil dignitaries of Bristol and Brighton will attend, and the Royal Air Force are being allowed by the Air Council to give their support.

LONDON AEROPLANE CLUB

Successful night flights for "B" licences have been made by Messrs. M. N. Mavrogordato and P. D. Wright at Croydon on Monday and Wednesday. Mr. L. Lipton paid a flying visit to Antwerp on Thursday and returned on Friday. Mr. J. Saxon Jones has passed his "A" licence tests, and Mr. G. Wertheim has joined the Club as a flying member. The good weather over the week-end resulted in 16 hr. flying on Saturday and 22 hr. on Sunday. Mr. Will Hay and Mr. N. Saxon Jones also paid a visit on Sunday.

HANWORTH (N.F.S.)

During the week Lady Nelson did a cross-country to Gatwick, Dr. E. Hahn a triangular flight for his "B" licence and Mr. D. Llewellyn also a cross-country for a "B" licence. On Friday three machines left Hanworth for Aintree and the Grand National. On Tuesday Messrs. G. Murray and C. Back successfully carried out tests for "A" licences. On Wednesday night-flying operations were carried out until 11 p.m., and on Thursday Mr. D. Llewellyn accomplished a night-flying test flight from Croydon to Lympne, thereby successfully completing all tests for his "B" licence.

Hanworth Club has always provided original and interesting entertainment for its members, and last Sunday, March 26, was no exception. In the evening, after dinner, there was a show of cinematograph films which carried the interest through from the earliest days of flying up to the present time. The first shown was a collection of news film, chiefly from Pathé, depicting the old days at Hendon and other parts of the world, taking people back to such events as the memorable first crossing of the Atlantic in a Vickers "Vimy" by Sir John Alcock and

POBJOYS ABROAD: Another foreign machine fitted with the British Pobjoy engine, the Italian Nuvoli N.5 monoplane, which has recently gone through its tests at Turin. So fitted, it has a top speed of 202 k.p.h., a landing speed of 76 k.p.h. and a cruising speed of 180 k.p.h., while the climb to 3,000 m. is 16 min. The weight empty is 246 kg. and the loaded weight 500 kg.

Sir Arthur Whitten Brown. Amongst those whom we saw flying, or getting into their machines, were Hamel ; Longcroft with the original B.E.2 ; Hucks, preparatory to looping the loop ; Sydney Pickles, with a Fairey seaplane in which he was to have flown the Atlantic ; trials of the first Sopwith " bat boat," Pegoud doing some of his early loops ; the arrival of the first American flying-boat ; Marcel Desoutter, and many others too numerous to mention. This is certainly a film which other club secretaries would be well advised to get for similar occasions. The next film was one taken by Col. the Master of Sempill during his trip in the *Graf Zeppelin* to South America, an exceptionally interesting record showing in many ways how comfortable travelling by this method is. Following this we were shown some of the early attempts of Mr. Lowe Wylde, who designed the first glider since the recent revival and flew it himself in Kent. From this he has, of course, developed the " Drone," and the film showed an excellent record of the way this small 6-h.p. machine flies. Mrs. Victor Bruce's plucky attempt on the world's refuelling endurance record was then shown, and there were many close-ups of the actual refuelling in progress. Incidentally, members were indebted to the Hon. Victor Bruce for the use of the projector which let them see films on this evening. Finally, there was an interesting modern film called " Pratts Motoring Review." This was a compilation showing the advance which has been made in various forms of motor-driven transport, including that in the air, on the water and on land.

BROOKLANDS AERODROME

The new rates and the fine weather have combined to make flying at Brooklands a popular pastime, and the number of hours done has now risen to an encouragingly high figure. The instructors have been hard at it all through the past week. Saturday and Sunday were, of course, particularly busy days, and the Club machines put in nearly 30 hr. over the week-end. Two new members have commenced instruction—Messrs. Williams and MacGregor. Regular pupils include Messrs. Hills, Cook, Ryan, Frost and Miss Meakin, all of whom have been flying constantly and piling up their hours. Three first solos have to be reported this week—those of Messrs. Frost, Vivian and Russell-U'Ren. The Club welcomes Maj. Empson and Messrs. Fuller and Pawson, all of whom have returned and commenced flying again after being absent during the winter. Mr. Palmer has been busy with photographic work, and one of the School machines was used to take aerial pictures of the motor-cycle racing on the track. Mr. Midgley is now taking the tests for his " B " licence. Capt. Ledlie returned from Germany on Thursday night, with Brooklands Airways' Junkers monoplane, which has been getting a new C. of A. at Dessau. He found bookings for two taxi jobs—one on Friday and the other on Saturday—awaiting him on his arrival, and started off for Aintree early on Friday morning, carrying a party to the Grand National.

READING AERO CLUB

The continuous fine weather has brought members and friends to Woodley in large numbers, and the air has resounded all day long with the sound of busy motors. During the week-end particular interest was aroused by various visitors, which included a Hawker " Fury." At tea time on Sunday there were no less than 20 machines on the aerodrome, including two " Puss Moths," a " Gipsy Moth," the " Pobjoy " Klemm and another " Gipsy Moth " flown by Mr. W. L. Handley, who had come over to see his Bristol " Fighter " which is ready for test. During the afternoon F/O. J. F. Lawn gave a display of aerobatics which was greatly appreciated. A Miles " Satyr " has been bought by the Hon. Mrs. Victor Bruce from Phillips & Powis, and the Duchess of Bedford has brought her " Gipsy I Moth " for a C. of A.

THE SOUTHEND FLYING CLUB

The flying hours have increased during the last week and totalled 16 hr. 38 min. On Wednesday the Spartan flew to Nottingham, and on Thursday Messrs. Fey and Ellison did their first solos. Alterations to the clubhouse are in progress and should be finished by next week-end.

MAIDSTONE AERO CLUB

Flying hours are steadily increasing as the days draw out, and the fine weather lately has been of great assistance. The number of ladies in the district who have started to take " A " licences is unusually high ; also a number of members have reached the solo stage and should be obtaining certificates shortly. G-ABAI is now back again in full swing after its recent crash, and members have now the use of two " Gipsy Moths." Turning to the social side, a monthly " At Home " will be held on Sunday, April 2 ; a Clay Pigeon Shoot on Saturday, April 8 ; and a Bomb Dropping Competition on Sunday, April 9. On April 17 Sir Alan Cobham's Circus will pay the Club a visit.

SURREY AERO CLUB

There has been considerable activity during the past week, Saturday and Sunday especially being delightful flying days. Under the leadership of Capt. Findlay, 18 machines arrived from Hanworth, two " Autogiros," flown by Messrs. Brie and Marsh, and machines from Reading and Shoreham, the pilots and passengers of these machines remaining to partake of an excellent lunch. Miss Delphine Reynolds flew her " Redwing " to Scotland, calling in at Wittering, Hedon, Cramlington, Stonehaven, and arriving at Aberdeen at 5 p.m. Miss Reynolds experienced terrific head winds both on the journey north and when returning. In spite of the fact that the " Redwing " was left in a field for two days, no difficulty was experienced in starting up the engine. On Wednesday, Miss Reynolds landed at Bicester beside a puff of white smoke which she erroneously mistook for a wind indicator ; actually it was a bomb, Miss Reynolds having landed near the bombing target. (In future chief instructors will have to include in their syllabus instruction in the signs always displayed on R.A.F. aerodromes during bombing.)

GRAVESEND AVIATION, LTD.

During the past week four new members have joined the school for flying, and also the Aerodrome Club. The Imperial Airways machine is still on the aerodrome, and is causing quite a lot of interest locally. The club-house will be open on Easter Sunday, when Sir Alan J. Cobham is bringing his Air Circus to visit Gravesend.

LYMPNE

High winds have hampered instruction, but in spite of this all available calm spells have been used to the full and quite a number of hours have been done. Miss Staple-Smith, Messrs. Geoghan, Fawcus and French have now completed their solo and "A" licence tests and are commencing advanced dual and the amassing of hours. Visitors for lunch include Prince Kinsky, Count Josef and Countess Wenckheim and Mr. Iystvan Dobos, who arrived from Vienna in two " Puss Moths." A welcome caller at the Club was Mr. C. W. A. Scott. He arrived in a " Fox Moth " which will form part of the " circus " travelling in aid of the hospitals this year.

SYWELL

The Club machines have been kept very busy during the past week, only one day having been bad for flying owing to storms and wind. Mr. Hamilton, the Club Secretary, has successfully completed his tests and hours, and has obtained his "A" licence. This has started the ball rolling, and the Club looks forward to an increasing number of " A's " as time goes on. Mr. Cattrell, a new pupil and member, has commenced instruction. Mr. Tyzack is carrying on a blind-flying course. Both these members are very keen, and are getting along famously. A deck tennis ground is being laid out on the aerodrome for the amusement of members ; this has been a very popular feature from time to time in the past, and it is hoped to get competitions going in the near future. It is also suggested that the Club should raise a cricket team for the season and challenge other aero clubs for a game. This seems an excellent idea ; will anyone interested please communicate with the Secretary. It has been noticed that large numbers of people seem to regard an aerodrome as sacred ground for the use of the favoured few, and peep through the hedge in fear and trembling! The Club points out that members of the public who are interested in aviation are welcomed on the aerodrome, and there is generally an official available who would be glad to show them round. Please remember that the Club is closed on Mondays, but on any other day go and watch the Club at work!

YORKSHIRE AEROPLANE CLUB (N.F.S.)

About 22 hr. have been flown at Yeadon during the past week. Three Club machines, a Desoutter from Hull and two private aircraft left Yeadon for the Grand National at Aintree on Friday, March 24.

HULL AERO CLUB (N.F.S.)

On Thursday, March 30, Capt. Norman Blackburn is giving a lantern lecture at the Club entitled "The History of the Blackburn Aeroplane Co." This will be the last lecture of the present season.

BRITISH GLIDING ASSOCIATION, LTD.

The 3rd annual general meeting was held on Monday, February 20, 1933, Mr. E. C. Gordon England taking the chair in the absence of Lt. Col. F. C. Shelmerdine. The following were present:—Capt. C. H. Latimer Needham, Dr. A. E. Slatter, Capt. A. N. Stratton, Sir Gilbert Walker, Col. the Master of Sempill, Messrs. S. Whidborne, L. O. Kekwick, D. Morland, R. G. Robertson, F. Pilling, E. G. Sanguinetti, A. J. Logette, C. Grahame-White and the Secretary.

The Master of Sempill, in paying tribute to the report of the Association's work during the past year, said that he particularly wished to endorse the President's remarks on the sterling work of the Honorary Treasurer, Mr. Whidborne, and to compliment the Association on their progress and on the 30 "C" licences which had been granted. The Master of Sempill also spoke in appreciation of the work of Capt. Latimer Needham, the Secretary and the Staff, but the Association's special thanks were due to the Chairman, Mr. E. C. Gordon England. The following officers were then elected for the year 1933:—President, Col. the Master of Sempill; Vice-Presidents, Col. Mervyn O'Gorman, Kathleen Countess of Drogheda, Mrs. J. A. Mollison and Air Com. J. A. Chamier; Chairman, Col. the Master of Sempill; Hon. Treasurer, Mr. Claude Grahame-White; Hon. Auditor, Mr. Claud A. Bloor; Hon. Solicitor, Mr. A. J. Logette.

BENGAL FLYING CLUB

February has been a busy month, despite the fact that the Club was closed for a week during the race for the Viceroy's Cup. Mr. C. P. Bhatt started dual on March 18, and Mr. R. J. Hawkings completed his tests for an "A" licence on February 28. On February 7 two machines, piloted by Mr. Dougall and Mr. B. K. Rose, left for Delhi. On the following day Mr. Biren Roy and Mr. Pal Choudhuri also left for Delhi, but owing to unfavourable weather returned to Dum Dum. Mr. and Mrs. Raynham, in their "Puss Moth," Capt. Lloyd in an Avro "Avian," and Wing Com. Crosbie in a "Puss Moss," also visited Delhi.

The Annual Gymkhana was held on February 5 before a large gathering, H.E. the Governor of Bengal performing the opening ceremony and presenting the prizes.

Two Hawker "Horsleys" of No. 36 Squadron called on February 16 for repairs on their way to Singapore. On February 22 Rene Lefevre arrived in his "Maubaussin," 40-h.p. "Salmson," on a return flight from China.

The total membership of the Club is 328. Four machines have been in use, and the flying times for February have totalled 8 hr. 25 min. dual and 121 hr. 45 min. solo.

ECONOMICS OF UNSUBSIDISED FLYING

IT was Mr. Winston Churchill who delivered the dictum, "Civil aviation will have to fly by itself." Although Great Britain has probably advanced as far as any nation towards that ideal, subsidies are still necessary for the running of our Empire air routes, and may remain so for a good many years. In other directions, however, very considerable progress has been made towards the production of economical aircraft. A welcome reminder of this fact is a little booklet entitled "The £ s. d. of Civil Aviation," which Mr. W. H. E. Thomas has produced for the de Havilland Aircraft Co., Ltd. The booklet does not, of course, belittle the merits of de Havilland aircraft, but at the same time it is of very great general interest in that, for the first time, it gives rise to a hope of escape from subsidies. Part of the booklet generalises on the subjects treated, and this part will be found of general interest in that it is applicable to all types of aircraft. The other section of the booklet deals more specifically with de Havilland aircraft, but is still of interest in that it gives chapter and verse for the basis of the generalisations. Mr. Thomas and the de Havilland Company deserve thanks for having given us a way of "getting down to brass tacks" by setting up a standard for comparisons.

We have on occasion discussed with Mr. C. C. Walker the subject of "payability" of aircraft, and know that Mr. Walker has made a very deep study of it. The basis of the booklet may, therefore, be assumed to be Mr. Walker's studies, although no mention is made of the fact.

In attempting to set up a yard stick by which to measure the "payability" of an aeroplane, no account is taken of overhead charges, since, it is pointed out, these will vary so greatly in individual cases that any attempt to estimate them would be mere guesswork. The rest of the charges are grouped under three heads: Those depending on the first cost of the aeroplane; those which depend upon horse-power; and those which depend upon the number of passengers carried per machine.

Under the first head obsolescence is taken at 25 per cent. (the machine is "written off" in four years), insurance at 12½ per cent. and interest on capital at 5 per cent. If an annual flying time of 600 hours is assumed, these charges will amount to 1.7d. per aircraft mile per £1,000 of first cost. The figure varies according to the number of hours flown.

Charges depending on horse-power are based on petrol at 1s. 5d. per gall. and oil at 4s. per gall. With maintenance these charges are assessed at 1.6d. per aircraft mile per 100 b.h.p.

Under the third head comes piloting, which is assumed at an average value of 2d. per aircraft mile.

Based on above estimates, a table has been compiled of the characteristics of a number of aircraft designated by letters. A is evidently the "Fox Moth" and E the "Dragon." The former is taken as unity, and the other machines in the table compared with it by working out their ratio to that of the "Fox Moth." The relative figures worked out in this table are:—First cost, number of seats, pay load for 400 miles range, first cost per ton of pay load, first cost per passenger seat, operating cost per machine mile, per ton-mile of pay load, and per passenger-seat mile. The "Fox Moth" works out at an operating cost of 1.87 per passenger-seat mile, and the corresponding figure for the "Dragon" is 1.85 per passenger-seat mile. These are merely relative figures and not shillings or pence.

The next section of the booklet deals with the opportunities which exist throughout the world for profitable operation of aircraft. Generally speaking, the arguments are quite sound, but when it is stated that "the aeroplane has no track, no corners, no level crossings, no grades," the writer seems to forget that the aeroplane is virtually always flying up a gradient corresponding to its L/D ratio at the particular speed at which it is flying.

The booklet makes out a glowing case for "ferry services," and after reading it one is almost tempted to go straight out to Stag Lane and buy a bundle of "Fox Moths" and "Dragons" and begin operations at once. The only thing which holds one back is the thought that perhaps after all one cannot count upon filling all seats on every flight. And is not that one of the most serious considerations? Presumably, if our railways could count upon every compartment being filled on every stage of every run, they would not be in the position in which they find themselves to-day. For irregularly operated services this question of full load does not arise to the same extent. Joyride firms wait until the machine is full before sending it up. But the operator who plans to run a regular service to a definite time-table must send his machines off whether they are full or not.

Table C, in which the cost of running a service between two towns 315 miles apart, omits to make allowance for any ground transport from aerodrome to town and *vice versa*. The same applies to Table E, which relates to an imaginary ferry service of 10 miles' length.

In the first part of the booklet the history of civil flying is briefly dealt with. Next comes a chapter entitled "The Remedy." The use of the past tense in this chapter is somewhat puzzling, and tends to obscure the meaning. The explanation probably is that the use of expressions such as *was, had to be*, etc., is meant to refer to pre-"Fox" and pre-"Dragon" days, and not, as one is apt to suppose, to the immediate post-war period.

The booklet is thoroughly interesting and thought-provoking, and we should have liked to publish it in full. This, however, is out of the question, but any FLIGHT reader seriously interested in the £ s. d. of flying can obtain a copy from the de Havilland Aircraft Co., Ltd., Stag Lane Aerodrome, Edgware, Middlesex.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

March 30, 1933

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A NOTE ON THE CONSTRUCTION OF CERTAIN STRUT CURVES.

By S. C. Redshaw, M.Sc., A.F.R.Ae.S.

Introduction.

It is probably safe to say that the most widely used formula for the strength of tubular struts is the one devised by Prof. Smith and modified by Prof. Southwell. This formula may be written in the following form* :—

$$\frac{P}{A} = \frac{f}{1 + \frac{\delta h}{k^2} \sec \frac{l}{2k}\sqrt{\frac{P}{AE}}}$$

where :—

P = the limiting load.
A = the cross sectional area of the strut.
f = the stress at the yield point of the material.
h = the greatest distance of any point on the section from the neutral axis.
δ = the equivalent eccentricity of loading.
k = the radius of gyration of the cross section.
E = Young's Modulus.
l = Length of the strut.

Unfortunately as $\frac{P}{A}$ occurs on both sides of the equation it is not possible to use it directly. If a series of strut curves are required they are usually drawn by means of the method described in the "Handbook of Strength Calculations."

By this method it is necessary to draw the Euler curve for the strut and then to form the required curve from it.

Now for commercial tubes it is usual to take :—

$$\delta = \frac{Internal\ dia.}{40} + \frac{length}{600}$$

then as δ varies with the length of the strut it is not possible to use the method referred to above with any great degree of accuracy because the scheme consists of selecting any ratio of $\frac{P/A}{f}$ from which the appropriate value of $\frac{l}{k}$ can be found from the Euler curve by a simple calculation. Therefore as $\frac{l}{k}$ is treated as the unknown quantity it is not possible to fix the appropriate value for δ at the commencement of the calculation as δ is a function of l.

It is possible to keep $\frac{\delta h}{k^2}$ constant if δ is made independent of l† but this approximation tends to do away with the accuracy of the formula which should be avoided if the information is needed for Data Sheets. Again it is often necessary to find the strength of one or two struts, perhaps with various changes in eccentricity or section, when it is quite unnecessary to draw an Euler curve and to go to the labour of constructing a complete curve from it.

By using the following alternative method these difficulties can be avoided and all the accuracy needed for Data Sheets may be obtained.

Differentials.

The well-known Theory of Differentials states that if $y = f(x)$, then $\delta y = \frac{dy}{dx}\delta x + \varepsilon\delta x$.

where ε is any assigned positive number no matter how small. In the limit, when $\varepsilon \to 0$, we may say that :—

$$dy = \frac{dy}{dx}\delta x.$$

Application to Strut Formula.

Consider the formula :—

$$\frac{P}{A} = \frac{f}{1 + \frac{\delta h}{k^2} \sec. \frac{l}{2k}\sqrt{\frac{P}{AE}}}$$

Now, if we take a definite value for $\frac{l}{k}$ then δ can be determined at once, and as the values of f, E and k are known from the data of the strut we are left with a single unknown $\frac{P}{A}$. We

* "Aeroplane Structures." Pippard and Pritchard.

† A.P. 970. Ch. 7, para. 17 (1).

TABLE SHOWING CALCULATION OF $\frac{P}{A} - \frac{l}{k}$ VALUES FOR DURALUMIN TUBES.

N.B.—Plot the underlined values of $\frac{P'}{A}$ against $\frac{l}{k}$.

$\frac{P'}{A}$	$\frac{P'}{AE}$	$\sqrt{\frac{P'}{AE}}$	$\frac{l}{k}$	$\frac{l}{2k}\sqrt{\frac{P'}{AE}}$ radians	$\frac{l}{2k}\sqrt{\frac{P'}{AE}}$ degrees °	′	$\frac{l}{2k}\sqrt{\frac{P'}{AE}}\sec\frac{l}{2k}\sqrt{\frac{P'}{AE}}$	ϕ	$\phi\frac{l}{2k}\sqrt{\frac{P'}{AE}}\sec\frac{l}{2k}\sqrt{\frac{P'}{AE}}$	$\frac{P}{A}$	$\frac{P}{A} - \frac{P'}{A}$	$\frac{l}{2k}\sqrt{\frac{P'}{AE}}\tan\frac{l}{2k}\sqrt{\frac{P'}{AE}}$	$\frac{d\left(\frac{P}{A}\right)}{d\left(\frac{P'}{A}\right)}$	$d\left(\frac{P'}{A}\right)$
30,000	0·002857	0·05345	20	0·5345	30	38	1·1622	0·1472	0·1710	31,560	1,560	0·5922	−0·0243	1,523
31,523	0·003002	0·05479	20	0·5479	31	24	1·1716	0·1472	0·1725	31,520	—	—	—	—
27,000	0·002571	0·05071	40	1·0141	58	7	1·8933	0·1944	0·3681	27,015	15	1·6076	−0·2194	12
27,012	0·002572	0·05072	40	1·0143	58	8	1·8941	0·1944	0·3682	27,012	—	—	—	—
20,000	0·001905	0·04365	60	1·3095	75	2	3·8721	0·2415	0·9351	19,100	− 900	3·7408	−1·130	− 423
19,577	0·001864	0·04317	60	1·2951	74	13	3·6765	0·2415	0·8879	19,575	—	—	—	—
13,700	0·001305	0·03612	80	1·4448	82	47	7·9604	0·2887	2·2982	11,205	− 2,495	7·8973	−3·252	− 587
13,113	0·001249	0·03534	80	1·4135	81	0	6·3925	0·2887	1·8455	12,988	− 128	6·3138	−2·866	− 33
13,083	0·001246	0·03530	80	1·4120	80	55	6·3343	0·2887	1·8287	13,065	—	—	—	—
8,600	0·000819	0·02862	100	1·4310	81	59	7·1705	0·3359	2·4085	10,843	2,243	7·1004	−4·526	406
9,006	0·000858	0·02929	100	1·4645	83	55	9·4362	0·3359	3·1693	8,865	− 141	9·3831	−5·140	− 23
8,983	0·000855	0·02925	100	1·4625	83	49	9·2842	0·3359	3·1180	8,976	—	—	—	—
6,200	0·000590	0·02430	120	1·4580	83	33	8·9019	0·3831	3·4100	8,381	2,181	8·8455	−6·741	282
6,482	0·000617	0·02485	120	1·4910	85	26	12·5598	0·3831	4·8120	6,359	− 123	12·5199	−7·579	− 14
6,468	0·000616	0·02482	120	1·4892	85	20	12·2913	0·3831	4·7085	6,475	—	—	—	—

may write

$$\frac{P}{A} = \frac{f}{1 + \phi \sec. \frac{l}{2k}\sqrt{\frac{P'}{AE}}} \quad \ldots \quad (1)$$

where $\frac{\partial\lambda}{k^2} = \phi$ for convenience and $\frac{P'}{A}$ is not necessarily of the same value $\frac{P}{A}$ but our object is to make $\frac{P'}{A} = \frac{P}{A}$.

This could be done by trial and error, but it would be too laborious and uncertain.

Differentiating $\frac{P}{A}$ with respect to $\frac{P'}{A}$ we have :—

$$\frac{d\left(\frac{P}{A}\right)}{d\left(\frac{P'}{A}\right)} = -\frac{\phi f}{E\sqrt{\frac{P'}{AE}}} \cdot \frac{l}{4k} \cdot \frac{\tan\frac{l}{2k}\sqrt{\frac{P'}{AE}} \sec.\frac{l}{2k}\sqrt{\frac{P'}{AE}}}{\left[1 + \phi \sec.\frac{l}{2k}\sqrt{\frac{P'}{AE}}\right]^2} \quad (2)$$

Now $\frac{P}{A} + d\left(\frac{P}{A}\right) = \frac{P'}{A} + d\left(\frac{P'}{A}\right)$

$$\therefore \left(\frac{P}{A} - \frac{P'}{A}\right) = d\left(\frac{P'}{A}\right) - d\left(\frac{P}{A}\right) =$$

$$\left\{1 + \frac{\phi f}{E\sqrt{\frac{P'}{AE}}} \cdot \frac{l}{4k} \cdot \frac{\tan\frac{l}{2k}\sqrt{\frac{P'}{AE}} \sec.\frac{l}{2k}\sqrt{\frac{P'}{AE}}}{\left[1 + \phi \sec.\frac{l}{2k}\sqrt{\frac{P'}{AE}}\right]^2}\right\} d\left(\frac{P'}{A}\right)$$

$$\therefore d\left(\frac{P'}{A}\right) = \frac{\left(\frac{P}{A} - \frac{P'}{A}\right)}{\left\{1 + \frac{\phi f}{E\sqrt{\frac{P'}{AE}}} \cdot \frac{l}{4k} \cdot \frac{\tan\frac{l}{2k}\sqrt{\frac{P'}{AE}} \sec.\frac{l}{2k}\sqrt{\frac{P'}{AE}}}{\left[1 + \phi \sec.\frac{l}{2k}\sqrt{\frac{P'}{AE}}\right]}\right\}} \quad (3)$$

Next select a value of $\frac{P'}{A}$ which it is thought will be very approximately equal to $\frac{P}{A}$ for any chosen value of $\frac{l}{k}$, then using this value of $\frac{P'}{A}$, find the value of $\frac{P}{A}$ defined by equation (1). It is an advantage to tabulate the work (see the table of the numerical example).

We may now write down the value of $\left(\frac{P}{A} - \frac{P'}{A}\right)$ and $\frac{d\left(\frac{P}{A}\right)}{d\left(\frac{P'}{A}\right)}$ can be found immediately from equation (2). The only quantity in this equation which has not already been evaluated is $\tan\frac{l}{2k}\sqrt{\frac{P'}{AE}}$, which can be taken at once from a table of natural tangents. Straight forward slide ruling gives the value of $d\left(\frac{P'}{A}\right)$ from equation (3), adding this correction to our previous value for $\frac{P'}{A}$, the process can then be repeated if necessary until $\frac{P}{A} - \frac{P'}{A}$ approaches zero. This is rendered necessary as, of course, the theory is only strictly correct for small differences. Even if a poor first approximation is made, two attempts only should be required for accuracy. In the numerical example, the third line has been evaluated merely as a check.

The values of $\frac{P'}{A}$ for the corresponding values of $\frac{l}{k}$ are then plotted in the normal way.

Numerical Example

To calculate a Strut Curve for hollow commercial Duralumin tubes.

Take $E = 10{\cdot}5 \times 10^6$ lb./in.²
$f = 16{\cdot}5$ tons/in.² (36,960 lb./in.²).

For struts whose diameter is great compared to the thickness of the wall, we have*

$$\frac{\delta h}{l^2} = \frac{1}{10} + \frac{l}{424\,k}$$

By means of this data, the various values of $\frac{P}{A}$ have been calculated for six values of $\frac{l}{k}$.

* A.P. 970. Appendix VII. para. 17 (3).

THE LOAD ON AN AILERON

By J. H. CROWE, M.Sc.

R. and M. 1443 gives the results of wind tunnel tests on aileron loads. Whenever loads are required on a flap, recourse will naturally be made to this R. and M. Although the Report covers a wide field, it is of course quite impossible to deal with every case that may arise, particularly as regards wing section, and as the centre of pressure position on the flapped portion of the wing is one of the determining factors in the load, it is therefore very desirable to have an analytical method of solving the problem if only as a check on the figures that have been taken as the result of wind tunnel tests.

The problem of finding the load on an aileron divides itself into two parts, first the determination of the load grading along the span, and secondly a determination of the pressure plotting along the cord of the flapped aerofoil. The first gives us directly the load on the outer portion of the wing containing the aileron, and the second gives us the proportion of this load on the aileron at various points. As regards the load distribution curve along this span, this is fully dealt with in R. and M. 1259, where a method of least squares solution suggested by Gates is employed. This should enable a load grading curve to be obtained for any values of aileron angle and any ratio of flap cord to total cord and flap span to total span.

For the fundamental equations used in finding the pressure plotting over the normal unflapped section reference should be made to Glauert's "Aerofoil and Airscrew Theory," pp. 88–90. We take as our origin of co-ordinates the leading edge of the aerofoil section and the x axis as the base line on the line joining leading and trailing edges. A new co-ordinate θ is taken such that

$$x = \frac{c}{2}(1 - \cos\theta) \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

If c is taken equal to 1 and x varies from 0 to 1, θ varies from 0 to π. The vorticity at any point is expressed by the series

$$K = 2V\left(A_0 \cot\frac{\theta}{2} + \sum_1^\infty A_n \sin n\theta\right) \quad \ldots \quad \ldots \quad (2)$$

Also if P is the pressure at any point $P = \rho VK$
Hence

$$\frac{P}{\rho V^2} = \frac{K}{V} = 2\left(A_0 \cot\frac{\theta}{2} + \sum_1^\infty A_n \sin n\theta\right) \ldots \quad \ldots \quad (3)$$

A_0 and A_n are given in terms of the centre line curvature of the aerofoil

$$\alpha - A_0 = \frac{1}{\pi}\int_0^\pi \frac{dy}{dx}\,d\theta \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

$$An = \frac{2}{\pi}\int_0^\pi \frac{dy}{dx}\cos n\theta d\theta \quad \ldots \quad \ldots \quad (5)$$

By direct integration of the lift and moment equations we have

$$K_L = \pi\left(A_0 \times \frac{A_1}{2}\right) \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

$$K_m = \frac{\pi}{8}(A_1 - A_2) - \frac{K_L}{4} \quad \ldots \quad \ldots \quad (7)$$

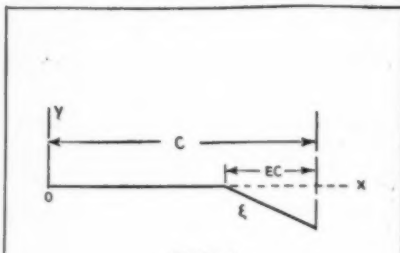
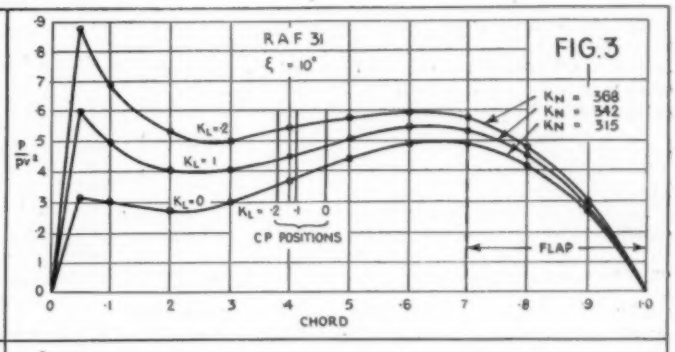
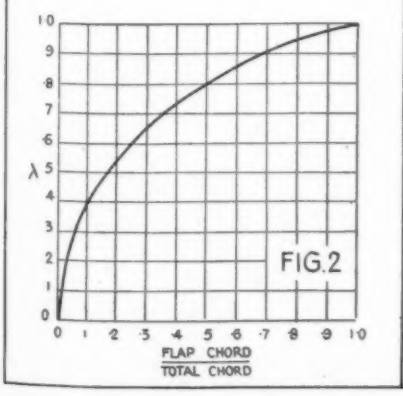
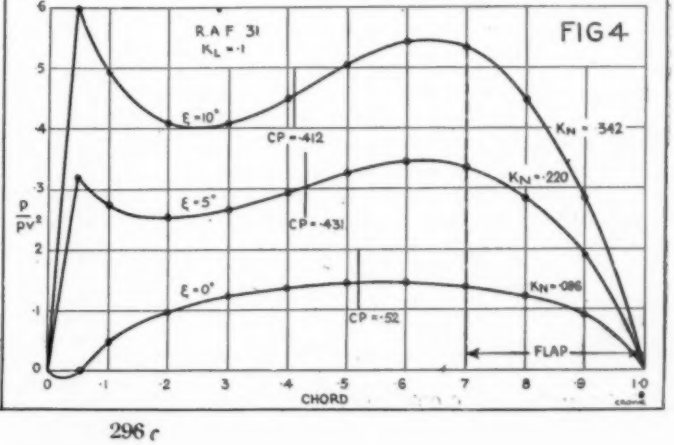


FIG 1







The first five equations enable us to determine the pressure over any aerofoil while equations (6) and (7) provide a useful check on the work. Actually it is proposed to use equation (6) to determine A_o. If the equation of the centre line is known, such as is the case for the R.A.F. 30 series, the problem can be dealt with analytically, but if the centre line equation is not known then graphical methods will have to be resorted to to find the values of A_n. Although the convergence of A_n is not in general good it should only be necessary to retain four harmonics.

Considering now the flap down case let ξ be the flap angle and referring to Fig. 1 let E be the flap cord. Denoting the co-ordinate of the hinge by ϕ we have

$$\cos\phi = (2E - 1) \quad \ldots \quad \ldots \quad \ldots \quad (8)$$

As before the X axis is taken as the base line of the original aerofoil. We have now from

$$0 \text{ to } \phi \quad \alpha - A_o = \frac{1}{\pi}\int_0^{\phi} \frac{dy}{dx}\,d\theta \qquad A_n = \frac{2}{\pi}\int_0^{\phi} \frac{dy}{dx}\cos n\theta d\theta$$

$$\phi \text{ to } \pi \quad \alpha - A_o = \frac{1}{\pi}\int_{\phi}^{\pi} \left(\frac{dy}{dx} - \xi\right) d\theta$$

$$A_n = \frac{2}{\pi}\int_{\phi}^{\pi} \left(\frac{dy}{dx} - \xi\right) \cos n\theta d\theta \quad (9)$$

Where $\frac{dy}{dx}$ has been replaced by $\left(\frac{dy}{dx} - \xi\right)$ for the flap portion of the aerofoil.

These equations hold good whatever the hinge position of the aileron. We should therefore expect little change in the load on an aileron for different degrees of balance. This is more or less borne out by the results of wind tunnel tests. Equations (9) may be more conveniently expressed as

$$\left.\begin{aligned} \alpha - A_o &= \frac{1}{\pi}\int_0^{\pi} \frac{dy}{dx}\,d\theta - \frac{\xi}{\pi}\int_{\phi}^{\pi} d\theta \\ A_n &= \frac{2}{\pi}\int_0^{\pi} \frac{dy}{dx}\cos n\theta d\theta - \frac{2}{\pi}\xi\int_{\phi}^{\pi} \cos n\theta d\theta \end{aligned}\right\} \quad (10)$$

By means of this last equation, we are enabled to determine the coefficient A_n for any particular case. It is suggested that A_o is best determined by equation (6) as before. The value of K_L with flap down, denoted by K_L' is related to K_L for the normal section by the equation

$$K_L' = K_L + \pi\lambda\xi \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots (11)$$

The curve for λ reproduced from R & M. 1095 is given in Fig. 2.

As a particular case R.A.F. 31 has been taken with a ratio of flap cord to total cord of 0·3. This aerofoil gives a simple expression for the value of $\frac{dy}{dx}$. The aerofoil has the same thickness over cord ratio as R.A.F 30, but has its centre line curved into a circular arc of camber 0·02. The equation of its centre line is easily shown to be

$$(x - 0{\cdot}5)^2 + (y + 6{\cdot}24)^2 = 6{\cdot}26^2$$

From which

$$\frac{dy}{dx} = \frac{0{\cdot}5 - x}{y + 6{\cdot}24}$$

or with no appreciable error

$$\frac{dy}{dx} = \frac{0{\cdot}5 - x}{6{\cdot}24}$$

Expressing this in terms of θ from equation (1)

$$\frac{dy}{dx} = \frac{\cos\theta}{12{\cdot}48}$$

A_n is then given by equation 10 as

$$A_n = \frac{2}{12{\cdot}48\pi}\int_0^{\pi} \cos\theta\cos n\theta d\theta \frac{2}{\pi}\xi\int_{\phi}^{\pi} \cos n\theta d\theta$$

By integration $A_1 = 0{\cdot}0802 + 0{\cdot}64\,\xi\sin\phi$

For values of n greater than 1 the first term disappears and there is therefore only one harmonic for the unflapped aerofoil. The value of A_n $(n > 1)$ is given by

$$A_n = \frac{2\xi}{\pi n}\sin n\phi$$

Two curves have been worked out, one with a constant value of aileron angle of 10° and K_L having the values 0, 0·1 and 0·2, and the other with a constant K_L of 0·1 and ξ having the values 0°, 5° and 10°, ϕ corresponding to E of 0·3 is by equation (8) = 113° 35′. The value of λ at E = 0·3 is 0·67. Values of A_o A_n and K_L' are given in the table. A_o has in each case been found from equation (6) where K_L' is substituted for K_L in the flap down cases, but it may be checked by finding it from equations (4) or (10). α in these equations is the angle of incidence to the base line so that the experimental value of the no lift angle should be subtracted from $\frac{K_L}{\pi}$ to give α. A further correction is needed if the cord line is not taken as the base line as is the case with R.A.F. 31. A check on A_1 and A_2 is obtained by inserting in equation (7) and comparing the K_{m_o} so found with the experimental value and with

$$K_{m_o}' = K_{m_o} = m\xi$$

in the case of flap down. Values of m are given in R. & M. 1095 and K_{m_o} is the experimental value of the no lift moment which is $-0{\cdot}029$ for R.A.F. 31.

Inserting the values of A_n in equation (3) gives the curves of figures 3 and 4. Fig. 3 shows the variation in load with the flap at 10° for different values of K_L on the unflapped aerofoil and Fig. 4 shows the effect of different flap angles. The first point taken has in each case been 0·05 and this has been joined by a straight line to the origin although by the nature of the curve required equation (2) approaches infinity as x approaches o.

The centre of pressure positions, which are marked on the figures, have been calculated from

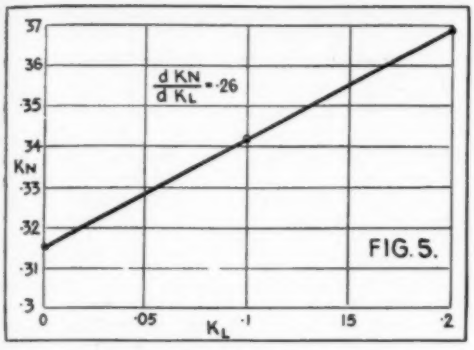
$$CP = \frac{dK_m}{dK_L} - \frac{K_{m_o} - m\xi}{K_L}$$

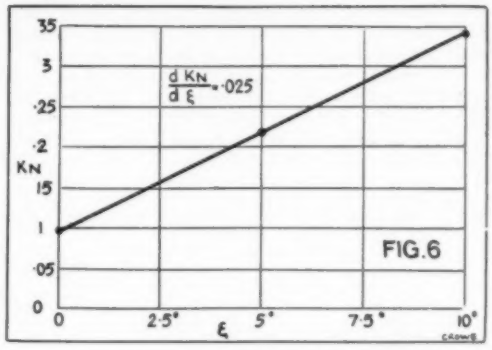
In which for R.A.F. 31 $\frac{dK_m}{dK_L}$ is 0·23; K_{m_o} is $-0{\cdot}029$ and m is taken as 0·32 corresponding to E = 0·3.

The effect of increase of K_L is as with the normal section to put the CP further forward thus putting less percentage of the total load on the aileron. The effect of increase of aileron angle is also with this particular section to put the CP more forward. This is due to the effect of the increase of K_L being greater than the effect of the flap. With a section such as R.A.F. 34 which has practically a zero K_{m_o} the reverse would be the case.

Figs. 5 and 6 show the aileron lift coefficient, K_n plotted against K_L and ξ, respectively. The value of $\frac{dK_n}{dK_L}$ is 0·26 and the value of $\frac{dK_n}{d\xi}$ is 0·025. The value of $\frac{dK_n}{dK_L}$ given in R. and M. 1443 as the result of wind-tunnel tests is 0·21. In the same report, the value of 0·25 for 0·28c aileron is given deduced from N.A.C.A. Technical Note 353. The values given in R. and M. 1443 for $\frac{dK_n}{d\xi}$ are 0·021 and 0·016 for an aileron cord of 0·28, the first being taken from the N.A.C.A. report, and the second the experimental value. Both these figures, however, that for $\frac{dK_n}{dK_L}$ and $\frac{dK_n}{d\xi}$ will depend on the section considered, and as R.A.F. 31 has a greater CP travel than either R.A.F. 28 or R.A.F. 34, which were the sections tested, we should expect somewhat greater values of aileron loading.

The CP of the aileron has been found to be at 0·39, and fairly constant within the range of aileron angle considered.





This agrees very well with R. and M. 1443, although up to 10° there is no indication of any increase in CP position with increase of aileron angle. The values of lift coefficient and CP coefficient on the front portion of the wing have not been calculated, but these are readily obtainable from the curves.

It was intended originally to work out some cases of a complete wing—aileron combination by first obtaining the load grading curve, and then calculating the pressure plotting at various points, but as this entails considerable calculations, if a number of cases are to be considered, it was thought better to limit this note to pressure plotting. From the calculations that have been done, however, there is reason to believe that for small values of aileron angle the load grading along the aileron is practically constant, only falling off at the extreme tip.

TABLE I

	$\xi = 10°$			$K_2 = 0·1$		
ξ ...	—	—	—	0°	5°	10°
K_L ...	0	0·1	0·2	—	—	—
$K_L{}^1$ ...	0·367	0·467	0·567	0·1	0·283	0·467
A_0 ...	0·0254	0·0577	0·0891	−0·0081	0·0252	0·0577
A_1 ...		0·1824		0·0802	0·1312	0·1824
A_2 ...		−0·0406		—	−0·0203	−0·0406
A_3 ...		−0·0122		—	−0·0061	−0·0122
A_4 ...		0·0276		—	0·0138	0·0276

THE PROPULSIVE EFFICIENCY OF AN AIRSCREW

By R. S. STAFFORD

When carrying out aeroplane performance estimates, it is very convenient if the additional drag caused by the slipstream can be debited to the airscrew thrust, rather than credited to the drag of the aeroplane. Thus, if the airscrew efficiency can be reduced by a factor which includes the additional slipstream drag, it becomes possible to base the calculation of the horsepower required (for the level flight of a particular aircraft) upon the normal lift/drag ratio, *i.e.*, the value of lift/drag which would be obtained in the absence of the airscrew. The method developed in this article is particularly useful, in that the result is expressed in terms of the characteristics of the particular airscrew under consideration, *i.e.*, no empirical factors are involved other than those which are contained in the usual assumption of constant slipstream disc area.

Let D = Airscrew diameter in feet.
ρ = Mass density of air, slug feet^3.
A = Area of slipstream disc, sq. ft.
V = Forward velocity of the aircraft, ft./sec.
S = Ratio of the square of the slipstream velocity to the square of the velocity of the aircraft.
T = Airscrew thrust in lb.
η = Airscrew efficiency without body interference.
η_P = Net airscrew efficiency including the effect of increased body drag.
$\eta_{PR} = \eta_P/\eta$.
J = V/nD, where n = airscrew rotational speed, r.p.s.
K_T = Airscrew thrust coefficient $\dfrac{T}{\rho n^2 D^4}$.
A_f = Equivalent flat plate resistance area of parts within the slipstream, sq. ft.
D_s = Drag of parts within slipstream = $A_f \rho V^2$.

On the simple Momentum Theory:

$$S - \sqrt{S} = \frac{T}{\rho A V^2} = a \text{ (say)},$$

Then $\sqrt{S} = \frac{1}{2}(1 + \sqrt{1 + 4a})$.

Now if $A = 0·6\,\pi/4\,D^2$,

we have $a = \dfrac{K_T \rho\, n^2 D^4}{\rho(0·6\pi/4 D^2)V^2} \quad \dfrac{1}{0·6\pi/4} \quad \dfrac{K_T}{(V/nD)^2}$

$$= \frac{1}{0·6\pi/4} K_T/J^2 = 2·12\, K_T/J^2$$

Now let ΔD_s = the increase in drag due to the increase of slip velocity.

$$= A\, \rho V^2 (S - 1).$$

Effective Thrust = $T - \Delta D_s$

and $\eta_{PR} = \dfrac{T - \Delta D_s}{T}$

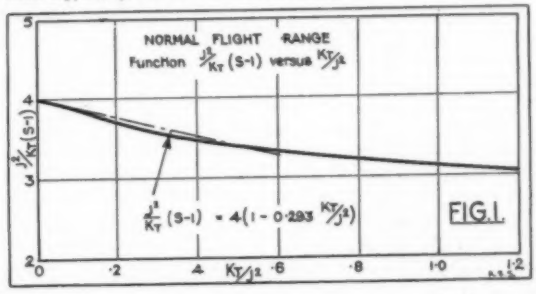
$$= 1 - \frac{\Delta D_s}{T}$$

$$= 1 - \frac{A_f \rho V^2 (S-1)}{K_T \rho n^2 D^4}$$

$$= 1 - \frac{}{D^2} \quad \frac{J^2}{K_T}(S - 1).$$

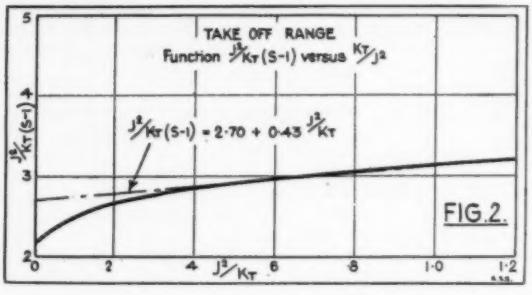
$$= 1 - A_f/D^2 \phi$$

Hence, for a given airscrew and for a given value of the ratio A_f/D^2, η_{PR} is a function of J only.



The curves shown on Fig. (1) and (2) show the function ϕ in a graphical form. It is necessary to plot the curve in two parts, for when J approaches O, S becomes very large and when K_T approaches O, J^2/K_T approaches infinity.

Fig. 1, which is applicable over the normal flight range, is plotted on K_T/J^2 as abscissæ, while Fig. 2, which corresponds to the take off condition, is plotted against J^2/K_T. The curves can be expressed with sufficient accuracy for all practical purposes, by the linear relationships :



For Normal Flight, $\eta_{PR} = 1 - 4\frac{A_f}{D^2}(1 - 0{\cdot}293\,K_T/J^2)$ (1)

For Take Off, $\eta_{PR} = 1 - \frac{A_f}{D^2}(2{\cdot}70 + 0{\cdot}43J^2/K_T)$ ... (2)

Using the characteristics of the airscrew family of R. & M. 829, the writer found that for airscrews with pitch/diameter ratio from 0·7 to 1·2, and with maximum blade width/diameter ratio from 0·07 to 0·10, equation (1) could be reduced to the following approximate formulæ :

For 2-Blader airscrews : $\eta_{PR} = 1 - 3{\cdot}9\frac{A_f}{D^2}$ at top speed.

and $\eta_{PR} = 1 - 3{\cdot}8\frac{A_f}{D^2}$ on climb.

For 4-Blader airscrews : $\eta_{PR} = 1 - 3{\cdot}8\frac{A_f}{D^2}$ at top speed.

and $\eta_{PR} = 1 - 3{\cdot}6\frac{A_f}{D^2}$ on climb.

These expressions are sufficiently accurate when a good first approximation is required.

The increase of lift arising from the lifting surfaces which fall within the slipstream, can, in general, be neglected when calculating level speed and climb performance, although the term A_f should include the flat plate resistance area equivalent to the profile drag of any such lifting surfaces.

Some recent tests in the American 20-ft. Propeller Research Tunnel show that wide variations in drag and propulsive efficiency may occur as the position of an air-cooled nacelle is altered with respect to a wing. Considerable variations in propulsive efficiency are disclosed with certain nacelle wing arrangements if the wing incidence is varied at a constant value of J.* When such test results are available we can determine an appropriate value for A_f to suit the particular nacelle-wing combination under consideration. In the absence of test results of similar nacelle-wing arrangements, the following approximate rules may be used to give a good first approximation.

Radial Air-Cooled Engines.—Assume that 50 per cent. of the bare nacelle (or fuselage) and engine drag is affected by the slipstream, while all other parts, such as bracing struts, oil coolers, wing surfaces, etc., are 100 per cent. affected by the slipstream.

Water-Cooled Engines and In-Line Air-Cooled Engines.—Assume that only 25 per cent. of the bare body or nacelle comes within the slipstream and that all other parts (including radiators) are 100 per cent. within the slipstream.

* N.A.C.A. Technical Report No. 415, "Tests of Nacelle Propeller Combinations in various positions with reference to wings." Part I. Thick Wing—N.A.C.A. Cowled Nacelle Tractor Propeller, by D. H. Wood.

TECHNICAL LITERATURE

1932 REPORT OF AMERICAN N.A.C.A.

The annual report of the American National Advisory Committee for Aeronautics contains a great deal of interesting information about the work done in America during 1932. Space does not permit of publishing the report in full, but the following extracts from the report of the Langley Memorial Aeronautical Laboratory may be of interest.

Langley Memorial Aeronautical Laboratory

CONTROLLABILITY AND STABILITY.—During the past year considerable progress has been made in an extensive investigation on lateral controllability. In this investigation the relative merits of various forms of ailerons and other lateral control devices are tested and compared in regard to their effect on lateral controllability and lateral stability at high angles of attack, and also their effect on airplane performance. The comparisons are based on wind-tunnel test data, all the control devices being fitted to model wings having the same span, area, and airfoil section, and being subjected to the same series of force and rotation tests. The investigation is being carried out mainly in the 7 by 10 ft. tunnel, but certain of the more interesting devices are also being tested in flight.

The wind-tunnel tests have been completed for the following arrangements: (1) Ordinary ailerons of three different proportions, all mounted in the usual position at the trailing edge of the wing, the ailerons being tested both locked to the wing and arranged to float with respect to the wing (Technical Report No. 419); (2) slotted ailerons and Frise ailerons (Technical Report No. 422); (3) ordinary ailerons rigged up 10 deg. when neutral, to eliminate the adverse yawing-moment characteristics of the ailerons with the usual rigging in line with the wing (Technical Report No. 423); (4) full-chord floating tip ailerons on rectangular wings (Technical Report No. 424); (5) spoilers and combinations of spoilers and ailerons on rectangular wings (Technical Report No. 439); (6) skewed ailerons on rectangular wings (Technical Report No. 444); (7) Handley Page tip slots and full-span slots with ailerons and spoilers (Technical Report No. 448); (8) ordinary ailerons on wings with rounded tips; (9) ordinary ailerons on tapered wings. Technical reports are in preparation covering items (8) and (9).

Square tips.—On rectangular wings with ordinary or skewed ailerons the direct rolling control at high angles of attack was best with short, wide ailerons rigged up 10 deg. when neutral and having an extreme differential movement from the rigged-up position, but the control forces required were exceptionally high. With the ailerons neutral, the autorotational tendency was found to be less with ailerons rigged up 10 deg. than when they were rigged even with the wing.

Rounded tips.—On wings with rounded tips reasonably satisfactory rolling moments at all angles of attack that can be maintained by average airplanes were obtained by short, wide ailerons, and particularly by short wide skewed ailerons on a wing with a long and slender tip. In general, the yawing moments were somewhat smaller for the ailerons on the wings with rounded tips than for the corresponding ailerons on rectangular wings.

Tapered wings.—Two wings tapered in plan, one tapered 5:3 and the other 5:1, were tested with ordinary ailerons. The ailerons on tapered wings gave better lateral control below the stall in regard to all three of the important factors, rolling, yawing, and hinge moments, than corresponding ailerons on rectangular wings, but with the 5:1 taper the rolling moments fell off almost completely just above the stall and adverse yawing moments of great magnitude occurred.

Floating tip ailerons.—Full-chord floating tip ailerons on rectangular wings gave definitely poorer general performance, particularly in regard to speed range and climb, than that for a wing with the same over-all dimensions and ordinary ailerons. At the higher angles of attack well above the stall, the control with the wing-tip ailerons was found to be greater than the assumed satisfactory value, whereas the ordinary ailerons failed almost completely. The floating tip ailerons gave no appreciable adverse yawing moments (body axes), but gave large favourable ones at high angles of attack. The autorotative tendency was not as bad as for the wings with ordinary ailerons.

Spoilers.—The investigation of spoilers showed that when spoilers and ailerons are used together, the full effect of both is not obtained if the spoilers are located directly in front of the ailerons. With the proper combination of spoiler and aileron, however, it is possible to obtain satisfactory rolling control up to high angles of attack (several degrees above the stall), together with favourable yawing moments and small control forces.

Wing slots.—Wind-tunnel experiments were made on a wing with various lengths of Handley Page tip slot to find the best length of slot for the prevention of autorotation. (Technical Note No. 423.) The best length was found to be 50 per cent. of the semispan, or slightly greater, for the particular arrangement tested.

Flight tests have also been made on an airplane equipped with Handley Page slots and flaps, to determine the effect of those devices on the lateral control, on the lift and drag, and on take-off time and distance. (Technical Note No. 398.) The airplane used was a low-wing monoplane having full-span automatic slots divided in such a manner that they could be used as tip slots only, if desired, and trailing-edge flaps which were confined to the portion of the span inboard of the ailerons. A tentative analysis of the results of the tests indicates that there is an approximately lineal variation of rolling moment with lift coefficient for the unstalled portion of the range of angle of attack, the moments decreasing with increased lift coefficient.

Separate airfoils as ailerons.—Wind-tunnel tests are now under way on ailerons consisting of small symmetrical airfoils separated from the main wing. They are being tried in a large number of positions with respect to the main wing. In each location the aileron airfoils are deflected for control in the usual manner, and also when allowed to float.

LANDING.—One obvious means of increasing the safety of aircraft is to reduce the minimum flying speed and increase the angle of glide, making possible landing and taking off in smaller areas. A report has been published covering the investigation on modifications to conventional airplanes giving nonstalling and short-landing characteristics. (Technical Report No. 418.) Such landings require that the landing gear be able to absorb a greater shock than the conventional gear would withstand. Some measurements have been made of glide landings with an airplane equipped with long-stroke shock-absorber struts. Further tests will include a study of the behaviour of the airplane during glide landings in gusty air. A method has been perfected for an accurate detailed study of the motion of an airplane for an approach in landing. A motion-picture camera on the ground is employed to record the various items of interest in connection with the study of landings and flight close to the ground. The results of an investigation made at the request of the Bureau of Aeronautics on the relative shock-absorbing properties of rubber-cord and oleo landing gears have been published. (Technical Report No. 406.)

LANDING SPEED AND SPEED RANGE.—In an effort to provide means for obtaining lower landing speeds and greater speed ranges, many devices have been developed for increasing the maximum lift without excessive increase of the minimum drag. These devices include pilot planes, slots, flaps, etc., most of which have movable parts entailing a certain amount of complication. In this field, wind-tunnel investigations have been made recently on Clark Y basic airfoils with various of these devices. In addition, to avoid the obvious objection to movable parts, tests were made on fixed slots and fixed auxiliary airfoils.

Fixed slots.—Aerodynamic force tests were made in the 5-foot vertical tunnel on a Clark Y wing equipped with several forms of fixed slot (Technical Report No. 407), and with four fixed slots and a trailing-edge flap. The slots were arranged to act singly and in combination to determine the optimum combination with the flap neutral and also with it deflected. (Technical Report No. 427.) On the basis of the maximum lift coefficient and the speed-range ratio $C_{L\,max}/C_{D\,min}$ with the flap neutral no appreciable improvement was found with the use of more than a single slot at the leading edge. On the same basis but with the flap down 45 deg. the optimum combination was obtained with only the two rearmost slots, the maximum lift coefficient in that case being 2.44 as compared with 1.29 for the plain Clark Y.

Flap modifications.—An investigation was made in the 7 by 10 foot wind tunnel on a model wing with split trailing-edge flaps of three different sizes. (Technical Note No. 422.) The flaps were formed of the lower rear portion of the wing, and were rotated downward about the axes at their front edges. The axes could be moved back in even steps to the trailing edge of the main wing, giving in effect an increase in area. The split flaps when deflected about their original axis locations gave slightly higher maximum lift coefficients than conventional trailing-edge flaps, and the lift coefficients were increased still further by moving the axes towards the rear. The highest value of $C_{L\,max}$, which was obtained with the largest flap hinged at 90 per cent. of the main wing chord from the leading edge, was 2.52 as compared with 1.27 for the basic wing.

Another high-lift device tested in the 7 by 10 foot tunnel was the Hall high-lift wing, which is essentially an airfoil having a split flap and also an internal air passage. (Technical Note No. 417.) The air enters the passage through an opening in the lower surface somewhat back of and parallel to the leading edge, and flows out through an opening made by deflecting the rear portions of the under surface downward as a flap. For ordinary flight conditions, the front opening and the rear flap can be closed, providing in effect a conventional airfoil. The tests were made with various flap settings and with the entrance to the passage both open and closed. The highest lift coefficient found, $C_L = 2.08$, was obtained with the passage closed.

Wind-tunnel tests were also made on a model of the Fowler variable-area wing (Technical Note No. 419), which consists of a combination of a main wing and an extension surface, also of airfoil section. The extension surface can be entirely retracted within the lower rear portion of the main wing, or it can be moved to the rear and downward. The tests were made with the nose of the extension airfoil in various positions near the trailing edge of the main wing, and with the surface at various angular deflections. The highest lift coefficient obtained was 3.17, as compared with 1.27 for the main wing alone.

Fixed auxiliary airfoil.—Another investigation made in the vertical wind-tunnel consisted of a series of tests on a Clark Y wing fitted with a narrow fixed auxiliary airfoil. (Technical Report No. 428.) The results of the wind-tunnel tests were so favourable that flight tests were also made with a similar auxiliary airfoil mounted on a small parasol monoplane. The addition of the auxiliary airfoil increased the lift capacity of the airplane 45 per cent., and the drag for the high-speed condition only 4 per cent. The minimum gliding speed was decreased 19 per cent., and the minimum gliding angle was unaffected. The maximum gliding

angle at low speed, however, was increased from 8.6 deg. to 16.8 deg., a change that tends to facilitate landing in restricted areas. The flight tests are in good agreement with the results predicted from the wind-tunnel tests. A report of this work is in preparation.

This investigation of fixed auxiliary airfoils is now being continued in the vertical tunnel to determine the best size and section of the auxiliary airfoil when combined with a main wing of Clark Y section. The original auxiliary airfoil used in both the wind-tunnel and flight tests was a highly cambered section (N.A.C.A. 22) and had a chord about 15 per cent. that of the main wing. At present, auxiliary airfoils with this section and also with a symmetrical section (N.A.C.A. 0012), and with the Clark Y section, are being tested in several different sizes each. The results obtained so far (N.A.C.A. 22 section only) indicate that the chord of the auxiliary airfoil has little effect on the characteristics of the combination except that when the chord of the auxiliary is increased to 25 per cent. of the wing chord the characteristics are slightly inferior. The optimum locations of the auxiliary airfoils, however, are considerably different for the different sizes. The effect of the auxiliary airfoil on the main wing appears to be due to the "scrubbing" action of the air over the upper surface of the main wing and the resultant suppression of the boundary layer, and not to the downwash from the auxiliary wing.

Load factors.—Special investigations of the applied load factors, or total loads, on military and naval airplanes during tactical manœuvres have been made and the information obtained has furnished, in large part, the basis of extensive revisions to structural design procedure for the types of airplanes involved. Further investigations of this type are in progress, including a study of the relation between the control force and the applied load factor in pulling out of a fast dive. Statistical data have been accumulated on the applied load factors experienced by transport airplanes on several routes during all seasons of the year. Although these data are not yet considered complete, enough information has been obtained to establish fairly reliable indications of the load factors to be expected during transport operations.

In as much as these data have been obtained on several types of airplanes under a variety of conditions of speed and loading, the results have been reduced to corresponding "effective" gust velocities on the basis of the assumptions of sharp-edge gusts and no pitching displacement. This procedure makes possible the plotting of curves of gust probability which show the expectancy of encountering "effective" gusts of given intensity during unit flying time. It has been found from data obtained in several thousand hours of flying that effective gusts of the order of 25 to 30 ft. per sec. occur about three times per 100 hours of flying, and that they may act either upward or downward with equal expectancy. Effective gusts of greater intensity than 30 ft. per sec. have not yet been encountered.

A special type of instrument which records the acceleration and air speed has been devised to aid in the accumulation of statistical data on load factors for airplanes. An advantage of this instrument is that it can be left unattended in an airplane for any desired period of time, and for this period it yields, in directly usable form, the desired data. Several such instruments are now in service.

The use of the vertical dive as a bombing manœuvre has required that special consideration be given to the applied load factors involved in pulling out of dives at terminal velocity and to means for reducing the terminal velocities. An investigation of the influence of the propeller on the diving speed has been completed, the results indicating that an adjustable-pitch propeller can be used to great advantage in controlling diving speeds for special purposes.

MANEUVERABILITY.—An investigation of maneuverability of airplanes, requested by the Bureau of Aeronautics, Navy Department, has been continued. The purpose of this investigation is to study the factors that influence maneuverability and to develop a satisfactory criterion of maneuverability. The quantitative data previously obtained have been augmented by the completion of tests with a Navy observation-type airplane. During these tests the pilot performed various selected maneuvers designed to show the separate and combined effects of the factors that contribute to maneuverability. A report on these tests is now being prepared.

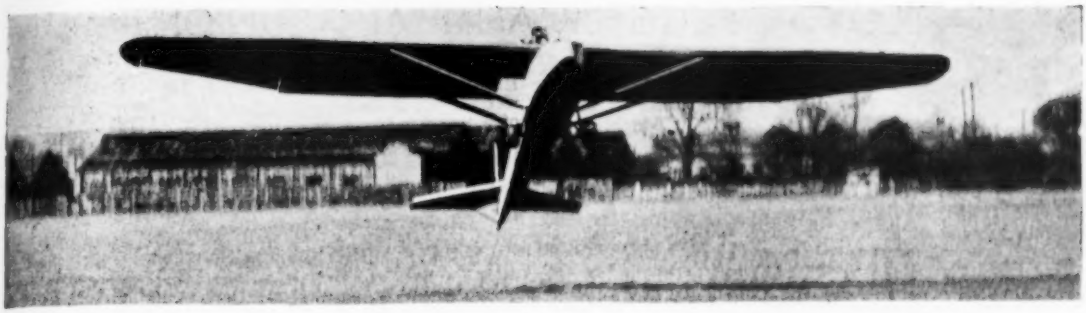
AIRFOILS.—*Tests in the variable-density tunnel.*—The investigation of a wide variety of related airfoils in the variable-density wind-tunnel has been completed, and the results published in preliminary form as Technical Notes Nos. 385, 391, 392, 401 and 404. Meanwhile, all the data have been assembled and the results correlated to show the trend of aerodynamic characteristics with changes of airfoil shape. This information will be made available in a technical report now in preparation.

The main investigation has been extended to include studies of the effects of certain additional changes in the airfoil shape. One series of tests was made to determine the relation between nose shape and the shape of the lift curve at maximum lift. For this purpose five airfoils were developed from the N.A.C.A. 2412 section by reducing the thickness of the airfoil forward of the maximum-thickness station. A technical note is in preparation giving these results. Another series of tests dealt with the effect of major changes of shape aft of the maximum ordinate. The N.A.C.A. 2412 section was again used as the basic airfoil and the trailing edge was upturned various amounts to produce a stable center of pressure. The results will be incorporated in the report on the main investigation mentioned above.

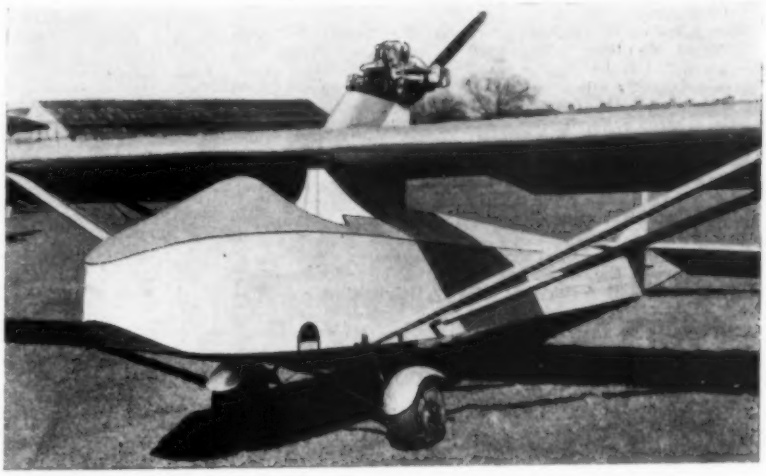
Several other airfoil studies have been conducted in the variable-density tunnel. Two airfoils of Göttingen 398 section modified by the addition of sharp leading edges were tested in connection with a study of the spinning characteristics of the wings, as described more in detail in the discussion of spinning. The results were published as Technical Note No. 416. Another investigation was made to determine the effects of fabric sag on the aerodynamic characteristics of airplane wings. Two airfoils simulating wings with sagged fabric between the ribs were tested and the characteristics compared with those of the wing without sag. It was concluded that the usual sagging of the wing covering has for practical purposes a negligible effect on the aerodynamic characteristics of the wing. (Technical Note No. 428.) The effect of surface texture on airfoil characteristics has also been further investigated during the year. These data are now being analysed for publication. They indicate that varying surface conditions have marked effects, and that certain of these effects are not likely to be predicted from low-scale tests.

Several routine tests of non-related airfoils have been made at the request of the Army and Navy to provide data for immediate application to practical problems. Tests of a series of well-known airfoils have been carried out through the range of angles of attack from negative maximum lift to positive maximum lift, to provide data needed in the structural design of certain types of airplanes. The results have been published. (Technical Notes No. 397 and 412.)

(*To be continued*)



CHEAP FLYING



AFTER considerable experimentation Mr. Lowe-Wylde has now evolved the final production model of his low-power aeroplane. Beginning with his two-seater glider, Mr. Lowe-Wylde merely took a Douglas motor-cycle engine and mounted it on a somewhat complicated framework above the wing. The machine flew, and flew quite well. It would even carry two people, but this was by way of being an overload for the engine. The next step was to convert the machine into a single seater, and to mount the engine on a plywood pedestal rising above the wing. This was equally successful, but for the first tests the petrol tank was retained in its old place above the engine, a position which gave the advantage of direct gravity feed, but which was somewhat unsightly. The final step is to put the tank in the engine-carrying stub, and it is in this form the machine is shown in the accompanying photographs. The appearance is greatly improved, and probably the performance slightly.

Compared with the early model, the production type of machine has a good deal better performance than the original. For example, recently Mr. Lowe-Wylde made a test of its climb. In half an hour he reached a height of 4,500 ft. The barograph curve showed two flat portions, which indicated that on two occasions he got into descending air currents which slowed down the climb. In undisturbed air Mr. Lowe-Wylde estimates that 4,500 ft. should be reached in about 25 minutes.

The machine makes possible rather a novel flying technique. For making a landing in a small field, the pilot brings it in down-wind at very low altitude and then, at the far end of the field, makes a sharp turn into the wind and lands. The fact that the machine is a high-wing monoplane makes it possible to bank fairly steeply quite close to the ground. For getting out of a small field the "circular" method can also be used.

In taking off in anything but a flat calm the machine will leave the ground in 50 yards. So long, therefore, as a little more than this distance is available in the direction facing the wind, the machine can get out of the field, because as soon as it is air-borne a gentle turn can be made, and height can be gained while circling.

The actual take-off is assisted by the fact that the machine is a pusher. The tail soon rises, and the first taxying period is done with the tail well up, *i.e.*, with the wing at no angle of incidence. This would not be possible in a tractor, as the propeller would strike the ground. Starting the engine is done by means of a stranded steel cable, a few turns of which are wrapped around a small drum on the propeller shaft and then given a sharp pull. When doing this Mr. Lowe-Wylde stands in front of the machine, so that if the throttle is left rather fully open, the machine cannot get away from him before he has time to reach the throttle lever.

FLIGHT] [*Photos.*

LLOYD'S REGISTER ANNUAL REUNION

THIRTY-NINE times Lloyd's Register of Shipping have now held their Annual Reunion and Dinner in connection with their cricket club, and since 1886 Mr. Andrew Scott, President of the club, has been a constant attendant, while at 31 of these dinners he has been in the chair. It was therefore with the greatest regret that everybody attending on March 25 found that illness had at last broken his amazing sequence. Dr. James Montgomerie had therefore to deputise for Mr. Andrew Scott, and proposed the toast of "Our Club and Patrons." In doing so he dilated upon the excellent record of the cricket club, which during the last season was unbeaten.

Sir George Higgins replied on behalf of the patrons, thanking Dr. Montgomerie for the way he had stepped into the breach caused by the most regrettable illness of Mr. Andrew Scott.

Sir Charles C. Barrie proposed the toast of "Our Outboard Members." The gist of his speech being that he himself felt he was an outboard member, and could therefore hardly advertise himself, but in any case he said Lloyd's men did not need advertising.

Mr. George Lyle, from Liverpool, replied to the toast in a humorous vein. He felt that everyone was proud to belong to Lloyd's, and that their feelings were typified by the hymn: "We are not divided, all one body we."

Mr. A. L. Sturge proposed the health of "Our Guests." He first of all remarked upon the excellent relationship which Lloyd's held with the Board of Trade and also to the fact that one of the distinguished gentlemen who would later reply to the toast was Lt. Col. F. C. Shelmerdine, Director of Civil Aviation. Other distinguished guests to whom he drew attention were Lt. Col. H. W. S. Outram, Director of Aeronautical Inspection, Dr. Hatfield, who had received the Bessemer Gold Medal for his work as chairman of the Corrosion Committee, and Col. the Master of Sempill. In reply, Mr. E. J. Foley, of the Board of Trade, deplored the absence of Mr. Andrew Scott, and suggested as a motto for Lloyd's that they should never leave to a government department anything which they could do better themselves. Also replying to the toast, Col. Shelmerdine drew attention to the fact that he was the guest of a very venerable institution, and that those who were shaping the course of British air transport could learn a lot from Lloyd's. He drew attention to the excellent work which the joint committee of Lloyd's Register and the British Corporation Register had done and were doing in aviation, and felt that although progress might be slow it would eventually have world wide importance.

Mr. Neville Dixey proposed the health of the Chairman, and after regretting the absence of Mr. Scott, eulogised Dr. Montgomerie for the excellent way in which he had undertaken such a difficult task at such short notice. This annual reunion is always a pleasant evening, for the speeches are interspersed with songs and other forms of entertainment. Mr. H. W. Soar and Mr. Ashmore Burch are among those whom we look forward to hearing every year, while the brothers Western and Leonard Henry are almost too well-known to need mention. One point about the evening is the large number of Scotsmen who are invariably present, and we would suggest in future instead of it being called the annual reunion of the staff of Lloyd's Register of Shipping it might more appropriately be called "Lloyd's Reunion of Scotsmen."

IN PARLIAMENT: THE ABOLITION OF BOMBING

IN the House of Commons on March 27 the following questions were raised in connection with the problem of aerial bombardment and its abolition:—

MR. RAIKES (Essex, South-Eastern, U.) asked the Prime Minister whether under the draft disarmament convention, aircraft co-operating with naval and military forces would be allowed to protect themselves against shells fired by anti-aircraft batteries by the use of air shells; and, if not, whether His Majesty's Government would propose the total abolition of anti-aircraft guns.

The hon. member also asked whether, under the draft convention, it would be permissible to use aircraft for the protection of undefended coastal towns in these islands against bombardment by enemy warships and for the defence of Singapore and other overseas bases against attack by naval forces or by troops conveyed in transports.

MR. MACDONALD (Seaham, Nat. Lib.).—The whole matter of measures consequential to the abolition of bombing will be considered should the abolition be accepted by international agreement. This and similar questions have been raised and are before the Ministerial Committee at the present moment.

CAPTAIN P. MACDONALD (Isle of Wight, U.) asked the Prime Minister whether the latest proposals for air disarmament contained in the draft convention had been examined and reported on by the Committee of Imperial Defence.

MR. MACDONALD.—The Government is solely responsible for the proposals in the draft convention. These were approved after most careful examination by a Ministerial Committee in consultation with the Chiefs of Staff of the three defence Services, and all elements of the Committee of Imperial Defence were present at those meetings.

Distribution of Aircraft

SIR P. LATHAM (Scarborough, U.) asked the Prime Minister whether he would state the grounds upon which it was proposed in the draft disarmament convention to allow Japan the same number of first-line aircraft as this country, having regard to the much larger area and population of the British Empire and the present inferiority of the Japanese Air Force to our own.

Replying to this question and another put down by Mr. Emmott (Glasgow, Springburn, U.) as to what was the basis of the calculation that no more than 500 aircraft were necessary to enable the Royal Air Force to perform its police work abroad, particularly in the Middle East, to provide an adequate home defence force for the protection of these islands, and to supply the machines essential to co-operation between the Army and the Navy.

MR. MACDONALD said that, as the House was aware, the figures in the draft were inserted as a basis for discussion and negotiation. The figures did not cover the Dominions or India, which were separately represented at the Disarmament Conference.

Commerce Raiding

CAPTAIN BALFOUR (Isle of Thanet, U.) asked the Prime Minister whether his Majesty's Government would consider adding to the draft disarmament convention measures for prohibiting the construction during the currency of that convention of new ocean liners, in order to prevent the misuse of these vessels for purposes of commerce raiding as in the late War, or, alternatively, measures for restricting their tonnage and speed.

MR. MACDONALD.—There is no proposal in the draft convention to abolish the Navy. If there were, then the question put by my hon. and gallant friend would undoubtedly arise.

CAPTAIN BALFOUR.—If the Government are unwilling to interfere with the Mercantile Marine, can we have an equal assurance that they will in no circumstance agree to measures which will cripple commercial aircraft?

MR. MACDONALD.—My hon. and gallant friend will remember that on three occasions that pledge was given. First by myself, then by the Lord President of the Council, and finally at Geneva.

Bombing of Civilians

CAPTAIN BALFOUR asked the Prime Minister whether, in view of the fact that the latest proposals in the draft disarmament convention relative to bombardment from the air had for their object the protection of non-combatants, and of the impossibility of securing that the prohibition of all air bombardment shall be respected in war, he would consider the advisability of substituting measures designed to preserve the civilian population from air attack.

MR. MACDONALD.—The question assumes that no international agreement will be carried out, but I would remind my hon. and gallant friend that one of the main objects of the abolition of bombing is to guarantee the safety of the civil population. Independently of this, we are taking precautions in this country to safeguard the civil population, so far as possible, against air attack.

CAPTAIN BALFOUR.—Is the right hon. gentleman not aware that the Lord President of the Council stated in terms that experience has shown that the stern test of war would break down all conventions?

MR. MACDONALD.—That may be so, and if my hon. and gallant friend would look at the form in which the statements have been made he will find that that has been kept in mind.

The Indian Air Force

THE Army and Air Force (Annual) Bill, which provides during 12 months for discipline and regulation, contains a clause amending the Air Force Act. A memorandum attached to the Bill explains that the Government of India have decided that steps shall be taken at once to begin the formation of the new Indian Air Force. The memorandum adds:—

The personnel of this force will be Indian and provision for its discipline has been made by an Act of the Indian Legislature—the Indian Air Force Act, 1932. It is necessary, however, to make provision to regulate the relations between members of the new force and members of the Royal Air Force when units of the two forces are doing duty at the same station or are otherwise serving together, and also to make provision for the discipline of members of the Indian force when attached to the Royal Air Force.

Fleet Air Arm Officers

FIVE naval officers who hold temporary commissions in the R.A.F. have just been promoted to squadron leader. They are the first naval officers to attain this rank in the R.A.F. Hitherto, so far as the *Air Force List* discloses, there have been no squadron leaders in the Fleet Air Arm. Each flight has been commanded by a flight lieutenant, and on each carrier the flying has all been under the control of a wing commander.

Air Transport

THE ORKNEY AIR SERVICE

FOLLOWING the opening of the Inverness municipal airport on May 5 and 6, a regular air service is to be inaugurated between Inverness and Orkney. A new company, styled Highland Airways, Ltd., has been formed with Capt. E. E. Fresson as General Manager and Chief Pilot. The first flight will leave Inverness at 10 a.m. on Monday, May 8. The journey to Orkney will take about 1 hr. 15 min., including a brief stop at Wick. A midday service will also be flown from Kirkwall to Thurso, connecting with the trains. This latter service will take about 20 min. compared with the four hours' sea voyage.

Capt. Fresson has stated that the help received from the Inverness Town Council has proved invaluable. The machine to be used on these services is the "Monospar" low-wing monoplane powered by two "Pobjoy R" engines developing 85 h.p. each. It possesses a cruising speed of about 115 m.p.h. and is capable of carrying three passengers and luggage.

It is of interest to note that it was three years ago since Capt. Fresson carried out numerous passenger flights at Wick, Kirkwall and Thurso with the aid of an Avro fitted with a 110-h.p. "Le Rhone" rotary engine. Over a dozen trips were also made between the mainland and Orkney, and Capt. Fresson at once foresaw the great possibilities of air transport in this part of Scotland.

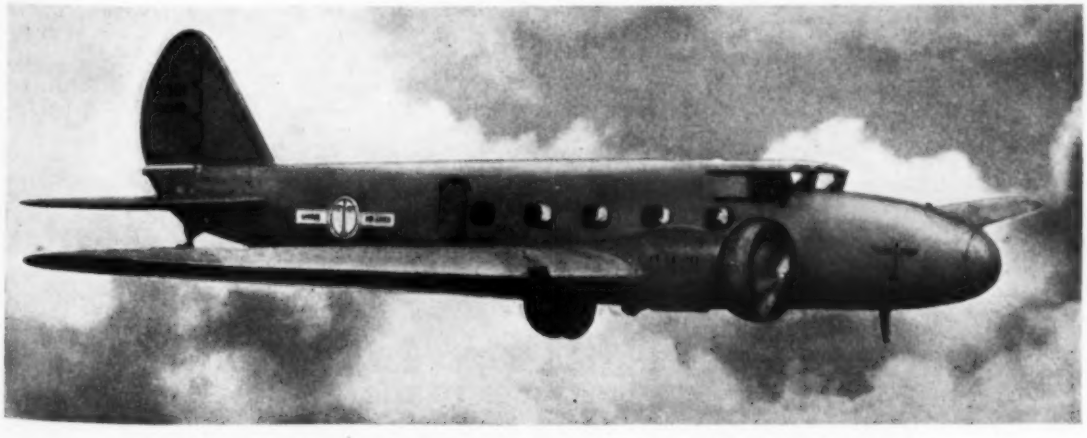
Capt. Fresson, therefore, set about trying to interest public bodies in the opening up of air services there, and made numerous flights, collecting data, etc., necessary for their operation. It was uphill work, but after two years' work he completed arrangements for the opening of a service. At the last minute, however, the new machine intended for this service was damaged during its trials, and as it was impossible to get it delivered—or obtain a substitute—in time for the service to be started that season, the scheme had to be abandoned.

There were many who thought that was the last of the idea of an Orkney air service—but they reckoned without Capt. Fresson, who persevered notwithstanding, and so there is every hope that this summer will see the Orkney air service in full swing.

Sketch Map of the Orkney Air Service.

High Speed, Strength and Comfort

SUCH are three of the outstanding characteristics of the new all-metal, low-wing, twin-engined Boeing transport aeroplane shown below. In test flights at Seattle this carrier surpassed even its estimated high performance, establishing its rating as the fastest multi-motored commercial transport in the world. The aeroplane carries a crew of three, ten passengers and cargo, is cleanly streamlined, is equipped with retractable landing gear and has two 550-h.p. supercharged Pratt & Whitney "Wasp" engines mounted forward of the leading edge of the wing. The Boeing Airplane Company is producing an entire fleet of the aeroplanes for United Air Lines. In service they are expected to bring about drastic reductions in air travel time on United's coast-to-coast, Pacific Coast and other routes. We hope shortly to publish further details and illustrations of this interesting machine.



The new all-metal 10-passenger Boeing transport aeroplane referred to above.

WIRELESS ON THE AFRICAN AIRWAY

INTERESTING details are now available as to the work which has been in progress in developing short-wave wireless signalling on the African airway. Being subject to electrical storms, some affecting 1,000 miles of territory at the same time, the African route is often unfavourable for long- or medium-wave wireless transmission, but with short-waves extremely good results can be obtained even under the most difficult conditions. Experiments conducted from Imperial Airways' aeroplanes and flying boats have resulted in the evolution of improved short-wave apparatus, designed to overcome electrical interference, which is now functioning with consistently good results, both on the ground and in the air. It provides telephone and telegraph transmission, between aircraft and ground stations, on a short-wave band of from 40 to 80 m., or on the medium-wave band between 500 and 1,000 m. In the new "Atalanta" air liners there is also an improved direction-finding equipment. While a machine is flying on its correct course no signal is heard from this instrument, but any deviation causes signals to be received which enable the pilot to estimate at once the amount of this deviation and to correct it quickly, thus being able to fly always on a direct line for the station with which he is in touch. During test transmissions between air liners and ground stations some remarkable results have been obtained, more particularly when working on the short-wave lengths. On one occasion, for example, while an aircraft was flying over the White Nile, between Juba and Kampala, it established contact with the British Post Office station at Portishead, near Bristol, a distance of 4,000 miles; while on another flight news items were picked up, and written down correctly, from a station which was broadcasting at Miami, in Florida. Similar long-distance contacts were also established with stations in Germany and Italy. Cairo, also, received short-wave messages without any fading from aircraft 1,300 miles away, flying southward towards Cape Town. Short-wave transmission now ensures a complete and efficient wireless service, between aircraft and ground stations, during electrical disturbances such as would render medium-wave communication impossible.

Even, for instance, when there is heavily-electrified rain, accompanied by lightning, this communication on the short waves can still be carried on.

The Boulton & Paul Mailplane

RARELY if ever in the history of British aviation has greater trouble been taken in the design and construction of a new aeroplane type than that bestowed on the new mailplane just completed at the Norwich works of Boulton & Paul, Ltd. Designed to an Air Ministry specification which called for a mail load of 1,000 lb. over a range of 1,000 miles at an average route speed of 150 m.p.h., this machine is expected to exceed very materially the design requirements. To achieve this result, however, Mr. J. D. North and his staff have had to design, test, re-design and re-test time after time. We believe we are correct in saying that about half-a-dozen wind tunnel models were made before the designers were satisfied that they had got the lowest drag possible out of the fuselage-wing-engine combination. The final result has been not only a performance well above that specified as a minimum, but what is, in a way, even more important, the extremely low drag means that if one engine stops completely it is not necessary to run the other at full throttle to enable the machine to fly on. Thus very great reliability indeed should be attained, and forced landings, at any rate hurried forced landings, should be almost ruled out. The machine will now be put through very searching official tests, and afterwards presumably it will be tried out on some air route in actual operating conditions.

Misr-Airwork's New Machines

WITH reference to the paragraph in our issue of March 9 in connection with an increase of capital for Misr-Airwork, we are informed that it is the intention of the company to purchase, not one large machine, but a fleet of six-passenger aircraft, to augment the smaller machines already in service in Egypt. Incidentally, Mr. F. A. I. Muntz, who has been in Iraq in connection with Airwork's subsidiary company operating in that country, returned to Heston on March 19.

American Air Mail Crash

AN American transport machine crashed on to a private house in California on March 25, killing 12 people. An entire family of six was wiped out, together with three visitors, the pilot, and two passengers. The petrol tank exploded, and the house with two adjoining houses were burnt to the ground.

THE HOUSTON EVEREST EXPEDITION

THE Houston Everest machines—the "Houston Westland," the Westland "Wallace," and the two "Moths," with the personnel supplemented by Col. Blacker, and F/O. R. C. W. Ellison—left Karachi on March 20 (as was reported in FLIGHT of last week). After refuelling at Hyderabad the expedition arrived at Jodhpur in time for lunch; here they stayed the night as guests of the Maharajah. On Tuesday, March 21, they arrived at Delhi, where the machines were inspected by the Viceroy. During the afternoon of March 22 the machines arrived at Purnea, the two larger machines being housed in two big tents at the excellent aerodrome 9 miles east of the town. The members of the expedition stayed at Darbhanga House, the property of the Maharajah of Darbhanga, the smaller machines being accommodated in a tent alongside the house. Two bases have been established; the first on the site of the mutiny battle at Lalbalu, 7 miles from Purnea, the second at Forbesgany, 50 miles nearer the mountain. A special meteorological station has also been erected. An experimental flight was carried out in a "Moth" to test an anti-freezing mixture.

On March 26 Air Com. Fellowes made the first reconnaisance of the mountain area in a "Puss Moth" with Mr. E. C. Shepherd as passenger. From 100 miles away a clear view was obtained of Everest. There was evidence of high winds over the mountains, great plumes of snow being blown off the crest of Everest's peak at intervals, and streaming away in grey streaks against the blue sky. The wind velocity at 11,000 ft. was estimated at 50 m.p.h., and the warm winds blowing up from the plains on to the snow formed a belt of white clouds.

The two aeroplanes and engines have been thoroughly examined in preparation for the great flight. The Bristol "Pegasus" engines, cruising at a speed of 110 m.p.h., consume about 20 galls. an hour. So far the weather has not been suitable for any serious trial flights, the strength of the wind varying from 22 m.p.h. at 1,200 ft. to 70 m.p.h. at 10,000 ft.

It is proposed, after the flight, to drop photographs at Kalimpong, from where they will be conveyed by runner to the expedition attempting to climb Mount Everest.

Dr. S. C. Roy, Officer-in-Charge of the Daily Weather section of the Meteorological Department in Poona, has been appointed special meteorologist to the Government of India in connection with the two attempts, one by air and the other by foot, to conquer Everest. Mr. Roy, trained in England, who has had several years' experience with the Department in India and has always been interested in aviation, was appointed in 1929 to organise new observatories inaugurated on account of the then rapid development of aviation in India. He is now in charge of Darjeeling and Purnea, the headquarters, respectively, of the main expedition and the Houston flying expedition, and will organise pilot balloon stations there, which will supply the expeditions with data in regard to wind velocities at different heights and similar information. After this Dr. Roy will go to Calcutta, where his sole duty will be to study conditions affecting Mount Everest and issue special forecast reports regularly for the benefit of the expeditions. It is likely forecasts will be dispatched by wireless from Calcutta, particularly for the benefit of the main expedition, which will be equipped with the best portable wireless plant available.

Airisms from the Four Winds

R.A.F. Long-Distance Flyers' Return

SQD. LDR. O. R. GAYFORD and FLT. LT. G. E. NICHOLETTS, who recently established the world's long-distance non-stop record by their flight of 5,340 miles from Cranwell to Walvis Bay, are now flying back to England by easy stages in the Fairey (Napier) long-range monoplane, which, since its arrival at Cape Town, has been overhauled and fitted with a standard Napier "Lion" engine. During their return they will be visiting various towns in the Union in order that the inhabitants may have an opportunity of inspecting the machine. They left Cape Town on March 13, and are due back in England early in May. The official itinerary of the homeward flight is as follows:—Kimberley ; Bloemfontein ; Durban ; Ladysmith ; Rand Cross of Sacrifice ; Baragwanath, Johannesburg ; Pretoria ; Bulawayo ; Salisbury ; Livingstone ; Broken Hill ; Mpika ; Mbeya ; Dodma ; Nairobi ; Juba ; Malakal ; Khartoum ; Wadi or Assuan ; Cairo ; Benghazi ; Tripoli ; Tunis ; Marseilles and Paris.

Kingsford-Smith

ON March 26 Sir Charles Kingsford-Smith completed his fourth crossing of the Tasman Sea from Ninety-Mile Beach, N.Z., to Mascot, Sydney, in the record time of 13 hr. 5 min. He was flying his famous Fokker monoplane *Southern Cross*, and carried a second pilot, a wireless operator, a mechanic, and a passenger. So enthusiastic was his welcome at Sydney that he received a slight injury while being chaired by the crowd. It will be remembered that Sir Charles accomplished the trip, in the same machine, from Gerrigong Beach, N.S.W., to New Plymouth, New Zealand, on January 11 last in 14½ hr. As on his previous flights, he employed Mobiloil and Lodge Plugs.

The Duchess of Bedford

THE Duchess of Bedford, who is flying from London to Bucharest, force-landed in a thick fog on the race-course at Kaposztasmegyer, near Budapest, on the afternoon of March 23. The machine was flown on to the City aerodrome, while the Duchess proceeded there by car.

High Altitude Accident

FLT. LT. G. H. STAINFORTH, while carrying out an experimental altitude flight at Farnborough, had the unpleasant experience of suddenly realising that his passenger, Mr. C. Watson, had collapsed. Mr. Watson's oxygen breathing apparatus apparently became displaced, and Flt. Lt. Stainforth was forced to make a quick descent. Mr. Watson was then taken to hospital, where he is recovering.

Another Stratosphere Ascent

M. MAX COSYNS, who accompanied Professor Piccard on his last ascent, intends to make a new ascent during the coming summer. The point of departure will probably be in South Belgium, and the balloon to be used has a capacity of 14,000 cubic metres, sufficient to carry it, unladen, to over 70,000 ft. With a load of about half a ton Mr. Cosyns expects to reach a height of 56,000 ft. In order to stabilise the balloon at great heights, a second balloon of 2,200 cubic metres will be attached below the sealed nacelle to act as a brake. At an altitude of about 33,000 ft. the larger balloon would be released for the ascent into the stratosphere.

Soviet War Minister Injured

A REPORT from Warsaw states that Voroshiloff, the Soviet Commissar for War, was injured when a machine in which he was a passenger crashed near the Polish frontier on March 26.

An Autogiro Taxi Service

EARLY this year the Miami-Biltmore and allied Florida Year-Round Clubs inaugurated an air-taxi service for their members with a 3-seater open-type Pitcairn Autogiro. Just recently a 4-seater cabin type Pitcairn Autogiro has been put into service, providing a regular schedule, carrying Club members and guests of the Roney Plaza and Miami-Biltmore Hotels between the Miami-Biltmore County Club and the Cabana Sun Club—40 min. by car, but 8 min. by Autogiro. Later it is intended to extend the service to include the Key Largo Anglers' Club, situated some distance further away. This cabin Autogiro is of the same type as that shown in our illustration below.

AMERICA'S FIRST CABIN AUTOGIRO: A striking picture of the Pitcairn 5-seater model hovering above New York, near the new 70-storey R.C.A. building in the Rockefeller centre.

PAPER AERONAUTICS : Another of Mr. Rigby's successful models in full flight in the Green Park. This model is an enlarged version—some 2 ft. span—of the Rigby "Swallow" previously described in FLIGHT. It is made entirely of stout paper, except for the metal airscrew and "engine mount," the wooden axle and the cork "balloon" tyres.
(FLIGHT *Photo.*)

At Buckingham Palace

THE following were amongst the guests invited to Their Majesties' Afternoon Party at Buckingham Palace on March 21:—Sir Christopher and Lady Bullock, Sir Malcolm and Lady Campbell, Group Capt. and Mrs. G. L. Carmichael, Wing Com. and Mrs. A. Grant, Group Capt. and Mrs. R. Leckie, Air Vice-Marshal and Mrs. C. Longcroft, Air Commodore and Mrs. C. T. Maclean, Wing Com. and Mrs. R. G. Parry, Lord and Lady Wakefield, Sqd. Ldr. and Mrs. H. S. P. Walmsley, etc.

Fatality at Boscombe Down

MR. H. L. S. SIKES, an undergraduate of Trinity College, Cambridge, was killed on March 26, when he crashed at Boscombe Down aerodrome. He was a member of the C.V. Air Squadron, and had started that morning from Duxford on a cross-country flight. It was stated at the inquest that his machine stalled on a turn at a height of about 400 ft.

Mollison's Return

MR. MOLLISON arrived back from South America on Monday, March 27. He had travelled from Buenos Aires in the *Avila Star*, and was joined by his wife at Madeira. They disembarked at Lisbon and proceeded by land to Paris, finally arriving at Victoria station during Monday afternoon. In the evening Mr. and Mrs. Mollison received a number of their friends at Grosvenor House, Park Lane, announcing that perhaps next month they would fly together to New York and, after waiting there for a full moon, would then endeavour to break the world's long-distance record by flying back to Europe and continuing as far as the machine would go. The "Dragon," which de Havillands have supplied to the Mollisons, is now being fitted with special long-range tanks at the Stag Lane Works, Edgware.

The Austrian International Meeting

WE hear from Prince Kinsky the regrettable news that no British entries have been received for the air rally being held at Aspern aerodrome, Vienna, on May 16. We have already drawn attention to the fact that the rules have, on this occasion, specially been framed to admit British machines, and it seems a pity that no private owners have been able to uphold our prestige on this occasion. Normal entries close on April 1, but there is still time for late entries (at a fee of 200 Austrian shillings), as these will be accepted up to May 1. The prizes offered are particularly good and well worth trying for, so let us hope that even yet some sportsmen may go over and show that our light aircraft are able to hold their own against anyone.

FREE PARACHUTE JUMPING

A PARACHUTE descent of exceptional interest was witnessed at Heston Air Park on March 15 when Mr. John Tranum dropped from Capt. C. Barnard's Fokker monoplane at 2,800 ft. and fell freely for exactly half that distance, namely, 1,400 ft., before opening his Irvin Back Type Parachute.

For the purpose of accurately determining the distance of the free fall, Mr. Tranum carried a stop watch in his hand and did not pull the rip-cord ring until it registered approximately 14 sec. The reading was taken by Mr. Leslie Irving, the parachute manufacturer, as soon as Tranum landed, and it confirmed the fact that Tranum reached his terminal velocity, namely, 119 m.p.h., during the fall. It has been proved by experiment that terminal velocity is attained when a human body has fallen 1,200 ft., which takes approximately 11 sec. After that distance there is no acceleration in the rate of fall, no matter how far the free fall is continued, in spite of the claims of reaching a velocity of 250 m.p.h. that are constantly being advanced on behalf of some parachutists.

Tranum turned three somersaults during his free fall, and there was scarcely any oscillation when the parachute opened. His Irvin equipment also included a Quick Connector Pack, carried on the front of his harness, but this he did not attempt to use, relying entirely on the Back Pack.

His jump was made for the purpose of providing a scene in a film, which an Elstree company is producing.

Given the necessary permission and facilities, Mr. John Tranum now proposes to attempt a world's record for a free-fall. There are many claims for this record, but few are authenticated. The only existing record of the kind recognised by the Irving Air Chute of Great Britain, Ltd., is one that was set up by an American, Mr. E. S. Manning, on March 1, 1931.

This parachutist dropped from an aeroplane at 16,665 ft. over Los Angeles Eastside Airport, and fell 15,265 ft. before opening one of his two Irvin parachutes. It was recorded on a barograph, the calibration of which was supervised by Mr. W. P. Balderston, of the Pacific Scientific Company and National Aeronautic Association of U.S.A.

Mr. Tranum will therefore have to exceed 15,265 ft. to beat the record. He is accepted by experts as one of the most experienced and skilful parachutists in the world, and there is no reason why he should fail in his endeavour. The successful demonstration of the long free-fall (usually and inaccurately described as a delayed jump) is useful as a proof that a human being can fall a great distance and still retain his faculties for opening a parachute. In genuine emergencies it often happens that an airman finds it necessary to fall a long distance to clear from the path of his falling machine before he opens his parachute. The fact that the manually-operated parachute permits this choice of action in an accident is one of its greatest virtues.

Airport News

CROYDON

TWO commercial travellers, Mr. T. H. Chamberlain and Mr. W. A. Burnside, left Croydon on Tuesday afternoon, March 21, in a "Segrave Meteor" monoplane for Cape Town. They will follow the Imperial Airways route as far as Nairobi and from there will call at all the principal towns in South Africa, lecturing and demonstrating their goods. Mr. Chamberlain said before leaving "Mr. and Mrs. Mollison have proved the reliability of British aircraft and aero engines—our object is to utilise these in a commercial way." They are the first commercial travellers ever to fly over an Empire air route, each holds an "A" licence certificate, and they will take turns in piloting the machine.

When the German airliner D.901, which left Cologne at 2.5 a.m. on Wednesday morning, March 22, arrived at Croydon 3 hr. later, it was still dark, and as the machine glided down it landed on the edge of a slope in the middle of the aerodrome. The undercarriage collapsed and the aeroplane skidded along for about 100 yd. before coming to a standstill, then tilted up almost on its nose. The pilot, Herr Drechsel, and a mechanic, the only occupants, jumped out both unhurt. Throughout the day mechanics were engaged in the task of dismantling the wings and placing a dummy undercarriage under the fuselage, and it was not until late in the afternoon that they were able to tow the machine into the hangar.

On Wednesday morning, Mr. Ramsay MacDonald, the Prime Minister, accompanied by Sir John Simon and Miss Ishbel MacDonald, arrived at Croydon, having flown from Paris on Imperial Airways airliner *Horatius*. As they stepped from the aeroplane they hesitantly posed for Press photographers and then passed hurriedly through the passenger booking hall to where their private car awaited them. They were about to move off when a Customs officer stepped on to the running board and asked the Premier for the usual declaration. Mr. MacDonald smiled and whispered something about half a box of cigars which he had taken out with him.

On Thursday morning, March 23, the Mayor of Carlisle, accompanied by two members of the Corporation and a Mr. Carr, flew in an Imperial Airways three-engined Westland, piloted by Capt. Leleu to Carlisle, where they made the first official landing on the new municipal aerodrome.

On Friday, the 24th, Sir John Simon left Croydon at 8.30 a.m. in an Air Union airliner for Geneva. The French Ambassador, who was visiting Paris, also travelled on the same aeroplane. Mrs. and Miss Ahlers, mother and sister of the dead German actress, left Croydon at 9.20 a.m. in the German airliner the same day for Hamburg. Two Air Union machines were used at midday to convey the Canadian and American Ice Hockey teams to Paris, and Imperial Airways were well patronised by racegoers who realised the advantages of travelling to Aintree by air.

Surrey Flying Services have purchased a Percival "Gull," which was flown on test by Mr. Cowan on Sunday. They will use the machine for fast taxi work.

So successful have been the experimental test flights of a new high-speed monoplane by the Deutsche Luft Hansa, that the new machine, a "Heinkel" (fully described in a previous issue of FLIGHT), will shortly operate a mail service between Berlin and Athens. The "Heinkel" is a single-engined low-wing monoplane, fitted with a retractable undercarriage and is credited with a cruising speed of well over 200 m.p.h. Mr. R. A. Jahn, Croydon Manager of the D.L.H., explained to me the possibilities of such a machine. "If fitted for passenger carrying it would have accommodation for six persons," he stated, "but for the time being it will only be used for mails, if satisfactory, which we have every reason to believe it will be, the 'Heinkel' will eventually be placed on the passenger services." This machine would place Berlin within 3 hr. flying of London, and it would be possible for one to leave Croydon after breakfast in the morning, have lunch in Berlin, and be back at Croydon again in time for tea, before leaving on the 5 p.m. aeroplane for Paris.

Among the passengers to arrive at Croydon on the Imperial Airways airliner *Hengist* on Monday, March 27, was Sir Harry Brittain, who was returning from the Cape. He was greatly impressed with the weather and said it was just wonderful to return to England and find it bathed in sunshine. Referring to his trip, Sir Harry said "I wish to praise this marvellous institution, Imperial Airways, who have brought me here, I have travelled 16,000 miles to Cape Town and back, and have now tested the longest Empire air route, confirming it by returning in the same manner in which I went out." He also remarked on the organisation of Imperial Airways, which, he said, was as perfect as any human machinery could be; all the members of the staff have a keen sense of service. The object of Sir Harry Brittain's visit was to see that part of the Empire in order to gather material for one chapter of a book he is writing about British flying.

The total number of passengers for the week was 1,171; freight, 50 tons 12 cwt.

"HORATIUS."

FROM HESTON

SUNDAY was not ideal for instruction or local flying, but three machines of the Berks, Bucks and Oxon Flying Club cleared Customs for St. Inglevert, piloted respectively by Messrs. Pudney and Ovey and Mrs. Battye. Prince Ali Khan visited the Airport and had a lesson with Capt. Baker on Tuesday; outward movements of aircraft included Capt. Styran to Ireland for the Banco service and Mr. Walker for Amsterdam, while Flt. Lt. Ivins arrived from Jersey in good time, having accomplished the trip in 1 hr. 40 min. The School had a busy day; amongst others were two new pupils. Wednesday also saw good weather for the School. Machines from both Hillman's and Birkett's air services left for the Lincoln Handicap with photographers, as did another machine, piloted by Capt. Newman. Mr. Brombridge left for St. Inglevert and Capt. Styran returned from Ireland.

Capt. Birkett flew to Liverpool on Thursday, and the Junkers, piloted by Mr. Ledlie, of Brooklands Airways, brought in two passengers from Amsterdam. The weather was too thick for school work, but traffic was otherwise plentiful. Friday, the day of the National, was the occasion of an abnormal amount of activity; at 9.30 the Tarmac was crowded with machines ready to leave for the race. Among those who took parties were Mr. Jackaman's "Monospar," one of Hillman's "Fox Moths," two "Puss Moths" for Birkett Air Services, the Banco Fokker, and Capt. Ferguson with Mr. Sammond in an Airwork "Moth." Mr. Robert Perkins, M.P., also left in his machine for the same destination.

Most of the machines returned early in the evening, but Mr. Jackaman's "Monospar" and a Hillman "Fox Moth" came in after dark. The latter machine landed with the floodlight and shadow bar, but Mr. Jackaman had made special arrangements that the floodlight should not be switched on for him, as he wished to land unaided with his own searchlight, fitted in the nose of his machine. The reports in the newspapers on the following day, that the floodlight had not been available for incoming aircraft, owing to a fire in the control room, were incorrect. After the last machine had landed there was a small fire, which was extinguished within a few moments of its discovery; repairs were put in hand at once, and there was in fact no interruption in the night-flying service whatsoever.

Saturday turned out a better day for the School, and the machines were kept hard at work. Mr. Gregory cleared Customs for Berck and Mrs. Vereker's "Puss Moth" left for Paris; two Hillman machines called to pick up passengers, amongst whom was a Paramount photographer. A welcome feature of the week-end was the return of a number of Heston *habitués*, drawn back to the Airport by the promise of spring and finer weather.

The Industry

FULL TIME AT FILTON

IN these days of despondency and pessimism in business it is cheering to find a factory where everybody is working at high pressure, and where the orders in hand are sufficient to warrant a night shift for several months, with the added assurance of steady work for the next 18 months or so.

This is the case at the Filton engine works of the Bristol Aeroplane Co., Ltd.

The " Pegasus " engine has, so to speak, " caught on," and is everywhere giving fullest satisfaction. Not at all a surprising thing when one has seen the engine being made. British goods are traditionally well made, and it is that hall mark given to them by extra good work—unnecessarily good according to some people—which has maintained sales against competition.

Bristol work has always been outstanding, and the finish they put on every part, even the smallest, of their engines is well nigh perfect. This, of course, inspires confidence, and no one who has seen the various parts going through the shops could ever have any doubts about the engine.

Their machining methods are most carefully laid out, and we were particularly interested in the new lathes for turning up the fins on the cylinders. The steel cylinders are turned out of forgings, and after the major work has been done upon them are set up in this new lathe between a double gang of tools, one side of which roughs the complete set of fins while the other side finishes them. The cylinder head is another extremely fine piece of work. This is now machined complete from the solid. Light alloy casting even nowadays sometimes gives trouble and the Bristol Company find that machining from the solid absolutely precludes any possibility of their getting any scrapped heads due to blow-holes or similar defects, besides getting a better head when finished.

Just as the finish of all parts of the engines is perfect, so is the state of the shops themselves. Even the benches look as if they were swept every few minutes, and there is a rumour that the only souvenir an engineer from a rival engine firm could find to take away with him was a small piece of dirt about the size of half a split pea, which he found on the floor and has carried in his cigarette case ever since.

Joking apart, though, the Bristol shops are really beautifully run and kept, and nothing will ever go out of them which will give anyone a chance to say that British engines are built by cheap or shoddy methods, which when used would probably " do the job," but would lower the tone of the whole engine.

SELF-LUBRICATING BEARINGS

SELF-LUBRICATING bearings have a very wide application in aircraft and have been sought after by manufacturers in every branch of engineering. Their need would now seem to be met by " Oilite," an ingeniously produced material made by the Manganese Bronze & Brass Co., Ltd., of Caxton House, Westminster. This material is manufactured by a patented process which has not only solved the difficulty of making porous metallic bearings of adequate strength, but also offers a method of forming many other porous articles. Put briefly, the process consists of compressing metallic powders, in this particular case copper and tin mixed in the proportion of 90 per cent. and 10 per cent. respectively, into solid briquettes under very high pressure. The briquettes are then sintered at about 1,500 deg. Fahrenheit, this temperature being below the melting point of copper, but above that of tin, consolidating the material, producing a strong porous article. By this means the amount of porosity is controllable up to 40 per cent. by volume. The bushes thus formed in dies are then impregnated with oil and finally sized to the tolerances required.

It will be seen from this brief description that the metal itself carries the oil and provides a perfectly distributed lubricating film throughout the whole length of the bearing, the volume of which adjusts itself automatically to suit the varying conditions of speed, pressure and temperature in the bearing. Where it is considered that additional lubrication is required, this may be supplied from a reservoir in the housing without the necessity for providing oil grooves or drilling holes in the bearing, the oil simply being filtered through the material itself and distributed equally throughout. The method of manufacture has resulted in the production of a material of both high strength and ductility, which can safely be used where press or force fits are necessary. Over ten million " Oilite " bearings have been put into service during the last two to three years, and they cannot, therefore, be looked upon as untried articles in any way. Another important point of this form of bearing is that it is extremely economical in oil consumption, for only just so much oil as is needed is extracted from the metal, and on cooling any surplus is immediately absorbed.

THE SPECIALIST DESIGNER

THERE is a growing tendency in aeronautical engineering to make more use of the specialist designer. It is undoubtedly a good tendency and will help to give us more efficient aircraft. Take, for example, the question of undercarriages. It is obvious that a designer employed in an aircraft factory cannot obtain experience on undercarriages faster than the rate at which his firm produces new machines. Nowadays this seldom means more than two a year. Supposing, however, that man was solely employed upon undercarriages and that he designed not only those for his own firm, but also for many other firms—as he could easily do if he had no other job—would he not gain experience of undercarriage design faster than he could do by any other method? The result would be that he would have all the idiosyncrasies of undercarriages at his finger tips, and he would, before long, be able to design the best undercarriage for any particular type of aircraft in a speedy and efficient manner, as he would very soon have a vast store of experience upon which to draw.

Now, Mr. G. H. Dowty, of Aircraft Components, Ltd., Cheltenham, is in just that position. We have often referred to the undercarriage shock absorber struts he has designed for various aircraft, and our readers will not be surprised to learn that his struts are finding increasing favour all over the world.

Mr. Dowty started his factory on an order placed by the Japanese for a number of his spring wheels, in June, 1931. Since that time he has turned out something like 300 pairs of struts. These have been designed for all types of aircraft, ranging from the lightest single-seaters to large commercial aircraft carrying over 40 passengers, including both amphibians and land machines. Abroad, his work is equally well known, and among the countries to which he has sent wheels or struts may be mentioned:—Japan, Siam, Poland, and Rumania.

In case some of our present readers were not readers when we last described the Dowty strut, it may be as well to point out that one of its chief attributes is the fact that when once installed it requires no maintenance whatsoever. It is essentially a telescopic leg sprung by a number of steel springs in series and generally damped by an oil dashpot arrangement. The layout does not require any pumping up or other attention and has the advantage of a small diameter.

It has been proved, if by nothing else, by the fact that several of the oldest established aircraft manufacturers are now having the struts for their undercarriage designed and made at Cheltenham, that a specialist like Mr. Dowty can produce a thoroughly good article at a competitive price.

CARS AND CARS AND CARS

THERE is something very satisfying in manufacturing an article for the enthusiast. A visit to the M.G. works will prove that fact. They are all enthusiasts themselves there, and seem to treat their own personal cars like the miner used to treat his whippet in the old port and egg days. A few minutes with one of the M.G. staff will soon make you think that all other makes of motor-cars simply don't count. The factory is very busy, as the demand for economical cars with a really high performance seems to grow every year, and when you have driven the

latest *Midget* or *Magnette* you'll know why. Who would have thought, a few years ago, that it would be possible to get an unblown 8-h.p. car doing 75 m.p.h.? Yet that's what the genius of Mr. Kimber has been responsible for.

He started with a weird and wonderful looking "hotted-up" Morris Oxford—he's still got it in the works—and from that the present models, so amazingly successful in races, have grown.

The factory itself at Abingdon inspires confidence in their cars as soon as you get there. There's no rush and bustle, generally inseparable from modern high-speed production methods, and consequently one is not led to wonder whether work is being skimped at all. There's an air of quiet efficiency about the whole place, and one immediately feels that a car in which so much personal interest is being taken must of necessity be good—and it is, we've tried them and we know. The *Midget* is a car that all flying people ought to know about, because every private owner must have a car nowadays, as well as his aeroplane. Many people can't afford a big car when they have to keep up an aeroplane as well, and may perhaps delay getting the latter because the performance of most small cars isn't good enough for them. They needn't. The *Midget* makes an ideal tender to an aeroplane, and is certainly one which will get its owner about as fast as any other car on the road.

Aviation Communications Consultant

GROUND organisation and general communication arrangements are getting more and more important in aviation, as the modern aerodrome must be fully equipped with wireless and navigational electrical lighting in order to deal adequately with the traffic. Capt. Duncan Sinclair has been associated with this sort of work for the past 13 years. His service with the R.F.C. and R.N.A.S. on many types of land and sea aircraft, as well as in the airships *R.33* and *R.36*, gave him a unique communications experience on which he was able to base his subsequent work in the Civil Aviation Department of the Air Ministry. As a matter of fact, he started his interest in wireless as far back as in 1910, when he owned one of the first transmitting stations in the British Isles. He was largely responsible for the successful negotiations with countries like Germany and Switzerland in establishing the international signals organisation for European Air Routes. During the past year he has been operating in conjunction with several of the largest commercial communications groups. Besides holding the first aircraft wireless telegraphy licence issued, he is an experienced pilot, and has also become well known for the part he played during 1929-31 in assisting with the establishment of the A.A. broadcasting station at Heston; also for the work he carried out with light aircraft wireless equipment. Capt. Sinclair has now established himself as Aviation Communications Consultant, and advises on all matters connected thereto. His office is Windsor House, Victoria Street, S.W.1 (Victoria 0816).

The London and Provincial Aviation Co.

WE are advised by the London & Provincial Aviation Co., of 3, Thackeray Street, London, W.8, that they have appointed Mr. J. N. Weir their sole Australian representative. Mr. Weir holds an Australian "B" licence and in addition is also a qualified ground engineer. He will be operating from Mascot Aerodrome, Sydney, and will look after all L. & P. interests in that country. L. & P. have been appointed aviation distributors of the C.T. Chain Wrench, and have also been appointed aviation distributors of Mixtrol, the upper-cylinder lubricant.

Goodyear Wheels and the Fairey "Seal"

WE are informed that the Goodyear Tyre & Rubber Co. (Great Britain), Ltd., of Wolverhampton, are supplying the 16 by 7-3 tailwheels fitted to the Fairey "Seal" aircraft of the Fleet Air Arm, which we described in our issue of March 16 last.

"The Pylon"

THE De Havilland Technical School have produced the second number of their machine "The Pylon," containing quite a lot which is of considerable interest. On the serious side there is an interesting article describing the elementary uses of electricity; turning to the lighter side there is a really clever little skit entitled "All This Aviation Business," after the style of "1066 And All That." Thereafter follows a summary of sport, a description of the old Sopwith Camel, and details of a model aeroplane. A well-produced little magazine well worth reading.

Change of Addresses

WILL readers please note that Airspeed, Ltd., have moved from their York factory to The Airport, Portsmouth (Telephone: Portsmouth 2444). Also, that at the end of this month the Comper Aircraft Co., Ltd., are transferring their works from Hooton to Heston Airport, Hounslow, to which address all correspondence, and goods, etc., should be addressed from now on.

F.P.1

SOME years ago an American inventor got out designs for a type of floating island which, it was intended, should be moored suitable distances apart across the Atlantic between Europe and America. The conception was daring in the extreme, but prolonged tests on scale models moored in rough seas, off the Florida coast, if we remember rightly seemed to show that the "Armstrong Seadromes," as these floating islands were called, were technically possible. The establishment of such a chain of floating islands would, however, be a gigantic undertaking from a financial point of view, and when the slump came in America the scheme, like many others, had to be placed in abeyance. The construction of a floating island has now been made the theme of an excellent film which will be released by the Gaumont-British Corporation at the Marble Arch Pavilion on Monday, April 3. We were privileged the other day to have a private view of the film, and as the subject is one in which flying figures to quite a considerable extent, we believe our readers will like to know something about the picture beforehand.

The "plot," broadly, is based on the struggles of the film equivalent of Mr. Armstrong to get his designs for a floating island taken up by a dockyard company. Powerful shipping interests see in the construction of such an island a threat to their business, and adopt somewhat drastic means to prevent the floating island from being built, and when, in spite of their efforts, it *is* built, they make a very nearly successful attempt to sink it at its moorings.

An adventurous flyer is the hero of the picture, an old friend of the inventor of the floating island, and when he sees the indifference with which the invention is treated by the shipyard owners, he "steals" the shelved designs (actually merely taking them out of their place in the filing cabinet and placing them in another office), at the same time taking care that press representatives are present to get the "story" of the stolen plans. This roundabout way of drawing attention to the designs succeeds in getting the owners of the shipyard interested, and they agree to proceed with the construction. After many troubles the island is completed and towed to its place in mid-Atlantic. Here it is all but sunk by representatives of various shipping interests, who have signed on as members of the crew.

The ultimate rescue is effected by the adventurous flyer, who, in spite of jealousy of his old-time friend the inventor of F.P.1, goes off in a makeshift aeroplane with badly-missing engine to look for a vessel which can supply the necessary oil for the Diesel engines of F.P.1.

The flying scenes are very well done, and the "floating island" (actually done partly with a model and partly with a faked dry dock or something of the kind) is extremely realistic. One sees a number of aeroplanes and seaplanes, including the huge Do.X, the size of which is completely dwarfed by the enormous F.P.1.

Apart from the fact that drama and humour are skilfully introduced, the film is very interesting in that it does give one quite a realistic impression of how such a "seadrome" might look, and who knows but that some day Mr. Armstrong's grandiose scheme may not be a serious rival to the tanker with trailing apron which the Luft Hansa is to try out this summer. The film is well worth seeing, whether from a general interest or a flying point of view.

SERVICES RUGBY

Royal Air Force *v.* Army

THE Army beat the Royal Air Force at Twickenham on Saturday, March 25, by two goals (one dropped) and a try (12 points) to a try (3 points), and thus the Army won the Services championship.

The result of the game was not unexpected, but the run of it was certainly a surprise. The Army had four English international forwards, Kendrew, Troop, Rew, and Sadler, and Ireland's hooker, Pike. In addition they had Novis, the captain of England, and the most thrustful scorer in the three-quarter line of any of the countries. What was to be expected but a huge tale of Army tries? True, the Air Force had the brothers Beamish, both Irish internationals, and Coote, whom some people think well worthy of an Irish cap, but on paper the odds were very heavily against the Air Force.

Well, the Air Force not only gave the Army a very good run for their money, but they even gave the Army supporters a bad fright. At one time it almost looked as if the Air Force would actually win the match. It would have been all wrong if the inferior team, the Davids so to speak, had mastered the Goliaths, but it becomes necessary to explain why they did not do so. The Air Force forwards had the better of their formidable opponents for the greater part of the game. For the most part, Valentine beat Pike for possession in the scrums, and when the Army did get the ball and heel, the Air Force wingers were round so fast on to the Army halves that the red three-quarter line was starved. At the last minute the Army had to play Dean at scrum half in place of Simpson, and the former's passes were not such as to put the Army third line in a strong offensive position. When Novis and Co. did get on the move, they were met by the most resolute and desperate tackling. On the other hand, the Air Force three-quarters were given plenty of opportunities, and it must be admitted that it was their lack of skill in attack which saved the Army from a big debit balance. In Rugby, wrong tactics often mean the sacrifice of victory. The Air Force ought to have realised that outside the scrum they had only one man with sufficient drive to make a try likely, and that man was Coote. They ought constantly to have fed their left wing. On almost the only occasion on which the ball came along the line to the left in a more or less orthodox manner, Coote easily outpaced the defence and scored a try. He should have been given many more opportunities to do it again. Actually, the majority of passes were sent out to the right wing, where the three-quarters were apt to bunch together and make the work of the Army defence only too easy. Then, when playing against a full back of the calibre of Radcliffe, it is folly to punt ahead into his hands. It is also folly to punt over the line when your own three-quarters obviously cannot outpace the defence. All those mistakes were made repeatedly, and consequently the grand work of the R.A.F. forwards was only rewarded with one try. The Air Force attacks were stopped too easily; the Army attacks were only thwarted by the skin of the Air Force's teeth. That could not go on for ever. The Army men were bound to score sooner or later.

One of the heroes of the match was McKern. His play could hardly have been better. He caught innumerable difficult kicks, he tackled dangerous Army runners when it seemed impossible that he should get to them, and all the while he was coolness personified. Williams was again his elusive, lively self, and the other R.A.F. outsides all did good things at times. Their tackling, in particular, was always a joy to watch.

There was no scoring in the first half. That in itself was a surprise. But there should have been a penalty goal to the Air Force. They were given a free kick right in front of goal at the easiest of ranges, and why Coote missed it is one of the mysteries of Rugby. After a quarter of an hour Leigh broke clear, and there was a scramble all over the field, in the course of which Troop hurt his knee badly and had to be carried off. There were numerous stoppages for injuries, mostly to Army men. Later on Novis hurt his ankle and was off for a few minutes, and Pike was also rather knocked about. These accidents took a good deal of the sting out of the Army, but there had not been too much of it before, and the effect of the Army casualties could easily be exaggerated. Once Croston looked to be in, but McKern just managed to get to his heels and brought him down. Soon after, the R.A.F. broke through, and Mermagen was only bundled into touch by the corner flag. Three times in that half the R.A.F. punted over the line and the Army touched down.

Soon after half time the Air Force were on the attack. Leigh cleverly gathered an erratic pass and broke through the centre with a side step. He passed out to Coote, but it looked as if the wing man must either be tackled or shoved into touch. But he opened his throttle and accelerated so suddenly that he threw the defence out of its reckoning, raced round Radcliffe, and scored a splendid try. Williams did not convert, but the Air Force had taken the lead, and well deserved it.

Play continued exciting and full of incident. Williams made a very sensational run. He seemed to be tackled decisively several times, but he continued to run, and how he did it is another mystery. Then the dangerous Crawford looked certain to score for the Army, but once more McKern brought off what looked like an impossible tackle.

In one of their raids the Army suddenly got dangerous. The ball went out to their left, but the way was blocked. It came back to the centre, and Croston dropped a goal. It was a good piece of judgment, and put the Army one point ahead. A quarter of an hour later, Dean whipped round the scrum and went through to McKern. Then he gave Crawford a simple pass, and the latter scored a try. Kendrew kicked a goal, and we realised that the R.A.F. had shot their bolt.

The final score came from a counter attack. The R.A.F. were pressing, and someone kicked for touch and failed to find it. Radcliffe sent back a stupendous kick, which did find touch by the R.A.F. 25 line. From the following scrum Hobbs dashed away, and passed to Dean, who fell over in the left corner. The kick failed, and then the whistle blew for "No Side." The R.A.F. went down with flying colours, and the wonderful Army side had very little reason to feel satisfied with its inevitable victory.

F. A. DE V. R.

The teams were :—

The Army.—Lt. S. T. A. Radcliffe (R.E.); 2nd Lt. J. A. Crawford (R.E.), Sapper A. J. Croston (R.E.), Lt. A. W. Tyler (R.A.), Lt. A. L. Novis (Leicestershire Regt.) (capt.); Lt. J. R. Cole (Loyal Regt.), Lt. G. J. Dean (R. Tank Corps; 2nd Lt. D. A. Kendrew (Leicestershire Regt.), Rev. V. J. Pike, C.F. (R. Army Chaplains' Dept.), 2nd Lt. C. L. Troop (D. of Wellington's Regt.), Lt. H. Rew (R. Tank Corps), Sgt. A. Boast (Welsh Gds.), L.-Cpl. E. H. Sadler (R. Corps of Signals), Lt. G. Taylor (W. Yorks Regt.), 2nd Lt. P. G. Hobbs (R.A.).

Royal Air Force.—P/O. R. N. McKern (Tangmere); F/O. P. B. Coote (Wittering), F/O. R. H. A. Leigh (Gosport), P/O. H. J. F. Le Good (Digby), F/O. H. W. Mermagen (Tangmere); L.A.C. S. Williams (Sealand), F/O. G. R. A. Elsmie (Hendon); F/O. C. E. St. J. Beamish (Eastchurch), F/O. G. E. Valentine (Netheravon), Sgt. J. S. W. Bignall (Duxford), F/O. A. L. Franks (Cranwell), Sgt. C. G. R. Lewis (Upper Heyford), F/O. C. R. Davies (Hendon), Flt. Lt. G. R. Beamish (capt.) (Henlow), A.C.1 G.E. Ford (Farnborough).

BOXING AT DE HAVILLANDS

ON Friday evening, March 24, there was held at the de Havilland Club, Stag Lane, a Boxing Display which it is hoped will be one of many. The boxing on the whole was quite good class, and every contest was fought with great keenness and in a thoroughly sportsmanlike manner, which is a treat to see in these days of commercialised sport.

In the first event Page of de Havillands beat Illian of de Havillands on points in a three-round Novice Featherweight contest. In a four-round Welterweight contest P.C. Gaskill of the Edgware Police was beaten by Pat Herrity of the Edgware Athletic Club on points after Gaskill had been down for a count of 7 in the fourth round. Gaskill was the cleverer boxer, though a trifle slow. Herrity was more pugnacious, better trained, and in the last two rounds used his left with great effect. In a six-round Catch-weight contest Whittam of de Havillands beat L.A.C. Fane on points. Whittam was obviously biding his time during the first four rounds, and only then displayed his true pugnacity; his foot work was good, especially in placing his weight. Cpl. Frost of the Royal Horse Guards knocked out Cpl. Scott in the last round of a three-round Light Heavyweight contest. After the interval, in a three-round Lightweight contest, Murphy, of Wealdstone Boxing Club, beat Daniels of de Havillands on points; Murphy was the more experienced boxer, though Daniels made good use of his right, getting in some effective punches in the last round. The three-round Welterweight contest between Clarke of de Havillands and Winterbourne of de Havillands was a poor fight for the weight. Clarke won on points. While one of the next contestants was changing Whittam and Fane gave an exhibition three rounds which was easily the best fight of the evening; neither appeared to be a bit tired after their previous fight, in fact, their fighting seemed more lively than before, and was certainly cleverer. Galvin of Barnes and Mortlake Boxing Club and L.A.C. Robinson of the R.A.F. then fought a six-round Featherweight contest. Robinson, who is Featherweight Champion of the R.A.F., won easily on points. He was the cleverer boxer, and kept out of reach of his opponent's long arms. The last contest of the evening was a drawn fight between Christie, Heavyweight Champion of the R.H.G., and P.C. Gough, Open Heavyweight Champion of the Edgware Police. Christie was the steadier fighter, and knew how to use his feet, in the sixth round he had Gough down once. Christie fought a very plucky fight, heavily handicapped by a bunged-up right eye, which swelled to a fearsome size; had this not been received the fight would have probably been his. In conclusion, Mr. F. T. Hearle presented very handsome prizes to the winners and to the visiting losers.

Fatal Crash of an "Argosy"

WE very much regret to learn that an "Argosy," *City of Liverpool*, G-AACI, bound from Cologne for Croydon, crashed near Dixmude on Tuesday, March 28. The pilot, Mr. L. L. Leleu, and all the passengers were killed. The number actually on board was not known at the time we went to press.

G.A.P.A.N. Civil Air Display

THE Civil Air Display, now established as a regular London seasonal fixture, will be held this year at Brooklands on Saturday, May 20. It will be opened by the Secretary of State for Air. The display is organised by the Guild of Air Pilots and Air Navigators in the foundation of which the late Air Vice-Marshal Sir Sefton Brancker took an active part, becoming its first Master. Royal Air Force assistance in the programme has been promised by the Air Ministry and the display has the active support of manufacturing and operating firms throughout the country. Sir Malcolm Campbell has expressed his intention of attending. The proceeds of the display are devoted to the Guild's Endowment Fund, which was subscribed nearly three years ago by the Honorary Wardens of the Guild in order to give the Guild a five-year period in which to establish its finances. The Display Committee's offices are at the offices of the Guild, 61, Cheapside, E.C.2 (Telephone: City 1827).

THE ROYAL AIR FORCE

London Gazette, March 21, 1933

General Duties Branch

The follg. Pilot Officers on probation are confirmed in rank :—G. Atkinson (Feb. 28) ; H. R. Allen, W. J. Craig, N. D. Crockart, A. W. Langton, G. E. Macdonald, W. McA. McAulay, H. M. Russell, E. G. Thompson (March 11).

The follg. are promoted with effect from Jan. 1 :—*Flight Lts. to be Squadron Leaders.*—R. St. A. Malleson, A.F.C. (Cdr., R.N.) ; E. W. Anstice (Cdr., R.N.) ; C. J. N. Atkinson (Lt.-Cdr., R.N.) ; E. M. C. Abel-Smith (Lt.-Cdr., R.N.) ; T. O. Bulteel (Lt.-Cdr., R.N.). *Flying Officers to be Flight Lts.*—G. Willoughby (Lt., R.N.) ; E. O. F. Price (Lt., R.N.) ; C. W. Byas (Lt.-Cdr., R.N.) ; L. G. Richardson (Lt.-Cdr., R.N.) ; G. C. Dickins (Lt.-Cdr., R.N.) ; C. R. V. Pugh (Lt., R.N.) ; C. John (Lt., R.N.) ; A. Brock (Lt., R.N.) ; J. W. Hale (Lt., R.N.) ; D. W. Mackendrick (Lt., R.N.) ; H. A. Traill (Lt., R.N.) ; C. A. N. Hooper (Lt., R.N.).

The follg. Pilot Officers are promoted to rank of Flying Officer :—E. R. Pearce, with seny. of April 23, 1932 (July 11, 1932) ; D. Addenbrooke, H. W. A. Chesterman, D. I. P. Macnair, N. C. S. Rutter (Jan. 25) ; R. H. Younghusband (Jan. 26) ; M. Hare (Feb. 6) ; A. G. F. Stewart, G. E. Strangeman (Feb. 27).

Air Vice-Marshal Sir E. R. Ludlow-Hewitt, K.C.B., C.M.G., D.S.O., M.C., is restored to full pay (Feb. 1) ; Lt.-Cdr. A. O. Watson, R.N., Flying Officer, R.A.F., ceases to be attached to R.A.F. on return to Naval duty (March 8).

The follg. Flying Officers are transferred to the Reserve (March 16) :—*Class A.*—E. G. Banham, F. P. Donovan, H. J. Forster, F. C. G. Freeman, E. S. Greenwood, J. A. Harris, T. R. Hope, H. T. Lines, J. H. Lock, R. Mountain, G. E. F. Proctor, L. H. Snelling, R. F. A. W. Williams. *Class C.*—A. N. E. Hall, N. X. Sheldrick, F. B. Taylor.

Flying Officer R. F. Williams relinquishes his short service commn. on account of ill-health (March 16) ; Lt. H. P. Madden, R.N., Flying Officer, R.A.F., relinquishes his temp. commn. on return to Naval duty (March 13).

Medical Branch

The short service commn. of F/O. (now Flight Lt.) F. W. P. Dixon, M.B., B.S., is antedated to Dec. 1, 1930. (Substituted for *Gazette* March 8, 1932) ; the short service commn. of F/O. L. M. Corbet, M.B., B.S., is antedated to Jan. 16, 1932.

Memorandum

No. 142768 Flight Cadet D. Urquhart is granted an hon. commn. as Sec. Lt. with effect from date of demobilisation.

ROYAL AIR FORCE RESERVE
RESERVE OF AIR FORCE OFFICERS

General Duties Branch

Pilot Officer on probation W. A. H. B. Burnside is confirmed in rank (Feb. 17). The follg. Flying Officers are transferred from Class A to Class C (March 18) :—G. Bliss, M.M. (Lt., R.A.R.O.), J. J. Hickman, R. H. McIntosh.

P/O. G. A. Hornblower is transferred from Class AA (ii) to Class C (Jan. 20) ; F/O. C. G. Davies is transferred from Class C to Class A. The following Flying Officers relinquish their commns. on completion of service :—J. C. Marcy (Jan. 14) ; J. Summers (Feb. 10).

SPECIAL RESERVE

General Duties Branch

H. F. Hamilton is granted a comm. as Pilot Officer on probation (Feb. 14).

AUXILIARY AIR FORCE

General Duties Branch

No. 608 (North Riding) (Bomber) Squadron.—Flying Officer I. W. H. Thomson to be Squadron Leader and to command the Squadron (Feb. 20).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Air Commodore C. D. Breese, A.F.C., to H.Q., Inland Area, Stanmore, 15.3.33, on appointment as Senior Air Staff Officer vice A/Cdre. J. B. Bowen, O.B.E.

Wing Commander E. J. P. Burling, D.S.C., D.F.C., A.F.C., to No. 205 (F.B.) Sqdn., Singapore, 10.2.33, to Command vice G/Capt. A. C. Wright, A.F.C.

Squadron Leaders : W. S. Caster, M.C., to No. 1 School of Tech. Training (Apprentices), Halton, 11.3.33, for Administrative duties in No. 2 (Apps.) Wing vice S/Ldr. W. E. Swann. J. F. Gordon, D.F.C., to No. 35 (B) Sqdn., Bircham Newton, 8.3.33, to command vice S/Ldr. H. M. K. Brown.

Flight Lieutenants : R. H. Barlow, to No 10 (B) Sqdn., Boscombe Down, 13.3.33. W. G. Campbell, to H.Q., Wessex Bombing Area, Andover, 13.3.33. J. W. Gillan, to H.M.S. *Eagle*, 6.3.33.

Flying Officers : G. Nelson to Superintendent of R.A.F. Reserve, Hendon, 13.3.33. M. D. C. Biggie, to No. 100 (B) Sqdn., Donibristle, 10.2.33. H. R. Lowry, to R.A.F. Depot, Uxbridge, 2.3.33.

Pilot Officers : The undermentioned Pilot Officers are posted to No. 2 Flying Training School, Digby, on appointment to Permanent Commissions :—H. J. Kirkpatrick, 27.2.33. D. Price, 3.3.33.

The undermentioned Pilot Officers are posted to No. 2 Flying Training School, Digby, on 15.3.33 :—H. R. Allen, W. J. Craig, N. D. Crockart, J. L. H. Fletcher, A. W. Langton, W. McA. McAulay, G. E. Macdonald, H. M. Russell, E. G. Thompson.

Acting Pilot Officer P. C. Hilton, to No. 4 Flying Training School, Abu Sueir, Egypt, 29.1.33, on appointment to a Short Service Comm. as A/Pilot Officer (on probation).

Stores Branch

Flight Lieutenants : F. H. Bedford, M.C., M.M., to No. 3 Stores Depot, Ruislip, 1.4.33. A. T. Wells, to No. 4 Stores Depot, Ruislip, 3.3.33.

Accountant Branch

Flight Lieutenant S. C. Wyatt, to No. 4 Flying Training School, Abu Sueir, Egypt, 1.3.33.

Medical Branch

Flight Lieutenants : J. M. Ritchie, to Palestine General Hospital, 10.2.33. S. B. S. Smith, to No. 45 (B) Sqdn., Helwan, Egypt, 6.2.33.

Flying Officer O. S. M. Williams, to Palestine General Hospital, 13.2.33.

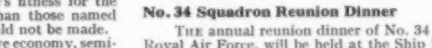
Dental Branch

Flying Officer P. J. C. Keane, to Station H.Q., Tangmere, 16.3.33.

NAVAL APPOINTMENT

The following appointment has been made by the Admiralty :—

Lieut. (F/O., R.A.F.) : F. W. N. Bassett, to *Leander*, for 407 Flight (March 22).



Enquiries concerning Candidates for Employment in the Royal Air Force.

The Air Ministry publishes the following :—

1. Much time and labour have been expended within the Air Ministry in dealing with representations and enquiries made on behalf of candidate's for employment in the Royal Air Force. The attention of all concerned is drawn to the following :—

(i) *Representations on behalf of candidates.*—The regulations governing such appointements make all necessary provisions for certificates or testimonials in support of applicants, including testimonials by individuals who have direct personal knowledge of the candidate's fitness for the appointment ; representations by individuals other than those named by a candidate in his application are irregular and should not be made.

(ii) *Enquiries.*—Further, as a measure of administrative economy, semi-official or private enquiries regarding individual applications for appointment should not be addressed, in writing or otherwise, to the branch concerned with the recuiting of candidates.

2. It is notified for general information that the following paragraph is being inserted in all regulations governing appointments in the Royal Air Force :—

"The regulations for the appointment of persons to employment in the R.A.F. provide, where necessary, for references as to the candidates' character and qualifications to be obtained from his former headmaster, employer, or other persons nominated by him. The department is not prepared to enter into correspondence, whether officially or unofficially, through members of the department, with persons other than these and the candidate's parent or guardian ; and the Selection Board will disregard recommendations from any persons who are not directly and personally acquainted with the candidate's work, at school or university, in industry or business, in H.M. Forces, or otherwise. Candidates are, therefore, enjoined to refrain from endeavours to enlist the support of Members of Parliament or other influential persons (except in the capacity of referees as provided for under the regulations), since to do so will merely prejudice their candidature."

Airworthiness Handbook for Civil Aircraft

Amendment Lists Nos. 29 and 30 of the Airworthiness Handbook for Civil Aircraft (Air Publication 1208) has now been issued and copies can be obtained from H.M. Stationery Office, Adastral House, Kingsway, London, W.C.2, or through any bookseller, price 2*d.* net, or 2½*d.*, post free.

Ground Engineers' Licences

The Air Ministry announces that :—(1) Examination Boards will sit for the purpose of examining applicants for ground engineers' licences at the following places and times :—(*a*) London, weekly, on each Wednesday in April, May and June, 1933. (*b*) Croydon, on the third Friday in April, 1933, and the second Friday in May and June, 1933. (*c*) Manchester, on the first Friday in May, 1933. (*d*) Bristol, on the first Friday in April, 1933. (2) Applications for licences should be made on C.A. Form 2B, which is obtainable on request, and should be addressed to The Secretary, Air Ministry (C.A.2), Adastral House, Kingsway, London, W.C.2.

No. 34 Squadron Reunion Dinner

The annual reunion dinner of No. 34 Squadron, Royal Flying Corps and Royal Air Force, will be held at the Ship Restaurant, 35, Whitehall, London, S.W.1, on Saturday, April 29, 1933, at 7.15 p.m. Tickets, 5s. 6d. each. Particulars may be obtained from Mr. K. Munro, Home Aircraft Depot, Royal Air Force, Henlow, Beds.

No. 46 Squadron Annual Dinner

The annual dinner of No. 46 Squadron, Royal Flying Corps and Royal Air Force, will be held at the Hotel Metropole (Georgian Room), Northumberland Avenue, London, W.C.2, on Saturday, April 1, 1933, at 7 p.m. Dress, dinner jackets. Particulars and tickets, 25s. each (inclusive of wines, etc.), may be obtained from Capt. C. J. Marchant, 91, Queen Victoria Street, London, E.C.4.

Second Class Aircraft Navigators' Licences (Civil)

The Air Ministry announces :—

In order to assist R.A.F. officers and non-commissioned officers who are contemplating taking up civil flying posts when they leave the Royal Air Force, a scheme has been arranged whereby pupils who satisfactorily pass the Navigation Course, Air Pilotage Course, the Flying-Boat Pilots' Course, or the Naval Observers' Course, will be exempted from taking the greater part of the examination for the Second-Class Aircraft Navigator's Licence. It should be clearly understood that no officer or airman can be accepted for such courses in order to assist him to obtain a civil aviation post.

All pupils desiring to make use of this arrangement will be required to take a supplementary examination in the subjects not covered by the above courses.

AIRCRAFT COMPANIES' STOCKS AND SHARES

THE favourable impression created by the steps taken in the United States to deal with the banking crisis and the more hopeful views regarding the situation on the Continent have tended to increase the volume of business in all sections of the stock and share markets. Chief interest has centred on British Government securities, but there was also more activity in ordinary shares of industrial companies. Aircraft and allied companies' shares have come in for a good deal of attention this month, and further movements in favour of holders have been established on balance; but in some directions best prices touched have not been maintained, the possibility of a substantial measure of international disarmament having caused a reaction at one time. Chief attention attached to Fairey Aviation, in which an active business has been transacted. Confirmation of the view mentioned here last month that an announcement regarding the redemption of the company's debentures could be expected drew attention to the shares, for this will, of course, effect a saving to the company and tend to make increased profits available for distribution to ordinary shareholders. De Havilland maintained their improvement of the previous month, as did Rolls-Royce, which were assisted by the excellent showing of the annual report, which discloses larger profits. As was anticipated, the distribution is again maintained at 10 per cent., but a considerably larger rate has been earned. In the case of D. Napier & Son, the annual report was considered disappointing, and on balance for the month there has been a decline in the ordinary shares from 4s. 3d. to 3s. 6d. The 7½ per cent. preference held up fairly well and the 8 per cent. preference are unchanged, the good and liquid financial position being a favourable factor, particularly as the chairman stated at the annual meeting that liquid resources are in excess of the requirements of the business, and that, although no decision has yet been made, the directors have under consideration the question of a return of capital to shareholders. There has not been much business in Handley Page preference, which remained around the rather lower price to which they went last month. Imperial Airways failed to hold the good advance recorded in these notes on the last occasion, for during the month there has been a reaction from 28s. to 24s. There was again an active business in Dunlop Rubber units, interest in which has shown an increase on estimates of a possible resumption of dividends with a small payment. Ford Motors have been reactionary, partly on the strike at the company's works and partly on fears of the annual report making a disappointing showing. Vickers were fairly steady on the favourable impression created by the past year's results.

Name	Class	Nominal Amount of Share	Last Annual Dividend	Current Week's Quotation
		%		
Anglo-American Oil	Deb.	Stk.	5½	101
Armstrong-Siddeley Develop.	Cum. Pref.	£1	6½	19/4½
Birmingham Aluminium Castg.	Ord.	£1	5	19/6
Booth (James), 1915	Ord.	£1	15	57/6xd
Do. do.	.. Cum. Pref.	£1	7	28/–
British Aluminium	Ord.	£1	5	25/–
Do. do.	.. Cum. Pref.	£1	6	22/6
British Celanese	Ord.	10/–	Nil	6/–
British Oxygen	Ord.	£1	3	27/1½
Do. do.	.. Cum. Pref.	£1	6½	25/7½
British Piston Ring ..	Ord.	£1	12½	30/–
British Thomson-Houston	.. Cum. Pref.	£1	7	27/–
Brown Brothers	Ord.	£1	10	33/9
Do. do.	.. Cum. Pref.	£1	7½	28/9
Dick (W. B.)	.. Cum. Pref.	£10	5	121/3
De Havilland Aircraft ..	Ord.	£1	2½	18/9
Dunlop Rubber	Ord.	c	Nil	20/9
Do. do.	.. "C" Cum. Pref.	16/–	10	21/3
En-Tout-Cas (Syston) ..	.. Def. Ord.	1/–	Nil	–/6
Do. do.	.. Ptg Pfd. Ord.	5/–	8	2/–
Fairey Aviation	Ord.	10/–	10*	20/6
Do. do. ..	.. 1st Mt. Deb.	Stk.	8	110
Firt (T.) & John Brown	.. Cum. Pref.	£1	6D	5/6
Do. do. ..	.. Cum. Pref.	£1	5*D	5/6
Ford Motor (England) ..	Ord.	£1	Nil	17/6
Fox (Samuel)	.. Mt. Deb.	Stk.	5	82½
Goodyear Tyre and Rubber	.. Deb.	Stk.	6½	104
Handley Page	.. Ptg. Pref.	8/–	10B	6/10½
Hoffmann Manufacturing	.. Ord.	£1	5	16/9
Do. do. ..	.. Cum. Pref.	£1	7½	21/3
Imperial Airways	Ord.	£1	3	24/–
Kayser, Ellison	Ord.	£5	Nil	50/–
Do. do. ..	.. Cum. Pref.	£5	6	70/–
Lucas (Joseph)	Ord.	£1	20	85/6
Napier (D.), & Son ..	.. Ord.	5/–	Nil	3/6
Do. do. ..	.. Cum. Pref.	£1	7½	19/4½
Do. do. ..	.. Pref.	£1	8A	12/6
National Flying Services	.. Ord.	2/–	Nil	–/4½
Petters	.. Ord.	£1	Nil	8/9
Do.	.. Cum. Pref.	£1	7½	10/–
Roe (A. V.) (Cont. by Armstrong-Siddeley Devel. *q.v.*) ..	Ord.	£1	—	—
Rolls-Royce	.. Ord	£1	10	48/6
Smith (S.) & Sons (M.A.)	.. Def. Ord.	1/–	Nil	3/6
Do. do. ..	.. Pt. Pfd. Ord.	£1	7	31/3
Do. do. ..	.. Cum. Pref.	£1	7½	23/9
Serck Radiators	Ord.	£1	12½	29/6
"Shell" Transport and Trading	Ord.	£1	7½*	41/10½
Do. do. ..	.. Cum. Pref.	£10	5	£11½
Triplex Safety Glass ..	.. Ord.	10/–	10E	40/3
Vickers	.. Ord.	6/8	4	6/7½
Do.	.. Cum Pref.	£1	5*	19/9
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—

* Dividend paid, tax free. £1 unit of stock. D Las xd. March, 1931. A Last xd. September, 1931. B Last xd. July, 1932. E On shares of £1 denomination.

Two More R.A.F. Caterpillars

F/O. ARTHUR J. PEGG, R.A.F., Martlesham Heath, was forced to abandon his aeroplane while flying at Martlesham Heath on March 21. He alighted safely with his Irvin parachute. This officer is the second member of the R.A.F. to qualify for membership of the Caterpillar Club this year, the first being Flt. Cadet A. M. Engineer, who saved his life at Cranwell on February 20.

The D.H. Technical School

THE number of hours flown by the De Havilland Technical School for the week ending March 25 was 30. Four students, Messrs. Dykes, Dubash, Turner and Wrightson have qualified for their "A" licence, while Messrs. Fisher and Pearce, ex-students, are flying to Cape Town in a Gipsy "Moth" which was built in the technical school. Mr. G. R. De Havilland flew over to France last week to collect a "Puss Moth."

Aircraft-Carrier Changes

THE aircraft carrier *Courageous*, Capt. Frank Elliott, O.B.E., flagship of Rear Admiral Henderson, will be paid off on May 2, at Portsmouth, and recommissioned the same day for further service in the Home Fleet. Her present ship's company joined on August 12, 1930.

The aircraft carrier *Eagle*, Capt. L. V. Wells, D.S.O., which is going to China to relieve the *Hermes*, will complete to full crew on April 18, proceed to Spithead on the 22nd to embark aircraft from Gosport, and leave for China about the end of the month, accompanied to Malta by the new flotilla leader *Duncan*.

PUBLICATIONS RECEIVED

Payen Guaranteed Gaskets. J. Payen, Ltd., Church Wharf, Chiswick, London, W.4.

The Aircraft Year Book for 1933. Compiled, Written and Edited by Aeronautical Chamber of Commerce of America, Inc. New York: D. Van Nostrand Company, Inc., 250, Fourth Avenue. Price $6.00.

NEW COMPANY REGISTERED

GRIMSBY ROADWAYS LTD.—Capital £600, in £1 shares. Acquiring the business of air express parcels service heretofore carried on by Wm. J. C. A. Hacker and John R. McCormick at 6, Portland Place, Grimsby. Directors: Wm. J. C. A. Hacker, Shelley, Portland Place, Grimsby, solicitor's clerk. John R. McCormick, 6, Portland Place, Grimsby, forwarding agents' manager. Solicitor: Walter West, Great Grimsby.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m. = motors. (The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

APPLIED FOR IN 1931

Published March 30, 1933.

18,671 E. G. BUDD MFG. CO. Welding. (388,770)
23,674 L. V. E. GRAY and G. S. SELMAN. Screw propellers. (388,827)
24,553 SIR W. G. ARMSTRONG-WHITWORTH & CO. (ENGINEERS), LTD., and C. M. BECKETT. Auxiliary engine sets for use in starting Diesel engines. (388,765)
25,318 J. DE LA CIERVA. Aircraft having rotative sustaining means. (388,830)
27,849 A. V. ROE & CO., LTD., and R. CHADWICK. Shock-absorbing struts for aircraft. (388,845)
29,494 FIAT SOC. ANON. Automatic valve-device for fuel supply systems. (388,856)

APPLIED FOR IN 1932

Published March 30, 1933.

1,885 SIR W. G. ARMSTRONG-WHITWORTH & CO. (ENGINEERS), LTD., and T. C. REAVELEY. Reversible air motor. (388,907)
10,003 J. R. C. CORONEL. Aeroplanes. (388,944)
22,125 C. R. M-A. DE ROUGE. Means for producing increased retardation of parachute-sustained aircraft immediately prior to alighting. (389,007)
28,934 A. T. S. Co., LTD., and J. D. NORTH. Aircraft Structures. (389,035)
30,300 A. T. S. Co., LTD., R. H. DOBSON, and H. N. WYLIE. Welded aircraft structures. (389,043)